SECTION 16141

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Device Plates.

1.02 RELATED SECTIONS

A. Section 16130 - Boxes

1.03 REFERENCES

A. NEMA WD 1 - General Requirements for Wiring Devices

B. NEMA WD 6 - Wiring Devices - Dimensional Requirements

C. NFPA 70 - National Electrical Code

1.04 SUBMITTALS FOR REVIEW

A. Section 01300 - Submittals: Procedures for Submittals

1.05 REGULATORY REQUIREMENTS

A. Conform to requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 WALL SWITCHES

A. Manufacturers:

1. Hubbell
2. Pass and Seymour
3. Bryant
4. Leviton
5. Substitutions: Under provisions of Section 01600.

B. Description: NEMA WD 1, heavy-duty specification grade AC only general-use snap switch.

C. Device Body: Plastic with toggle handle. Handle to be gray.

D. Indicator Light: Lighted handle type switch; red color handle.

E. Voltage Rating: 120/277 volts, AC.

F. Current Rating: 20 amperes.

2.02 WALL DIMMERS

A. Manufacturers:

1. Lutron
2. Prescolite
3. Lightolier
4. Engineer approved equal
5. Substitutions: Under provisions of Section 01600.

B. Description: NEMA WD 1, semiconductor dimmer for incandescent lamps. Shall be capable of controlling lighting intensity over the complete range from full off to full brightness with integral on/off switch.

C. Device Body: Ivory plastic with linear slide. Slide color to match device body.

D. Voltage: 120 volts.

E. Power Rating: 600 watts minimum.

F. Accessory Wall switch: Match Dimmer Appearance.

2.03 RECEPTACLES

A. Single Convenience Receptacle:

1. Hubbell Model HBL5361GY
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

B. Duplex Convenience Receptacle:

1. Hubbell Model BHL5362GY
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

C. GFCI Receptacle:

1. Hubbell Model GF300HGY
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

D. Hospital Use Receptacle:

1. Hubbell Model 8300
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

E. Isolated Ground Receptacle:

1. Hubbell Model IG 5362
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

F. 30-Amp, 125/250 Volt, 3-pole, 4-wire Grounding Type Single Receptacle (NEMA 14-30R):

1. Hubbell Model 9430A
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

G. 50-Amp, 125/250 Volt, 3-pole, 4-wire Grounding Type Single Receptacle (NEMA 14-50R):

1. Hubbell Model 9450A
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

H. Telephone Jack (Four Conductor):

1. Hubbell Model C14BR
2. Pass and Seymour
3. Bryant
4. Leviton
5. Engineer approved equal

I. Substitutions: Under provisions of Section 01600.

J. Color: Gray with light walls. Brown with wood or dark walls or as indicated on the drawings.

2.04 WALL PLATES

A. Materials

1. Stainless Steel: Type 302 or 304, No. 4 finish, 0.040 inch thick, accurately die cut, protected with release paper.
2. Cast Metal: Die cast profile, ribbed primed with grey enamel, furnished complete with four mounting screws.
3. Gaskets: Resilient rubber or closed cell foam urethane.
4. Steel: Hot dip galvanized.

B. Application

1. Flush Mounting Plates: Beveled type with smooth rolled outer edge, stainless.
2. Surface Box Plates: Beveled, steel, pressure formed for smooth edge to fit box.
3. Weatherproof Plates: Cast metal, gasketed; for receptacles, provide spring loaded gasketed doors.
4. Where two-gang boxes are required for single gang devices, provide special plates with device opening in one gang and second gang blank.

PART 3 EXECUTION

3.01 EXAMINATION

A. Section 01039 - Coordination and Meetings: Verification of existing conditions prior to beginning work.

B. Verify outlet boxes are installed at proper height.

C. Verify wall openings are neatly cut and will be completely covered by wall plates.

D. Verify floor boxes are adjusted properly.

E. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean debris from outlet boxes.

3.03 INSTALLATION

A. Install products in accordance with manufacturer=s instructions.

B. Install devices plumb and level.

C. Install switches with OFF position down.

D. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Install receptacles with grounding pole on top.

G. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

I. Use jumbo size plates for outlets installed in masonry walls.

J. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

3.04 MOUNTING HEIGHTS OF WIRING DEVICE OUTLETS

A. Coordinate locations of outlet boxes provided under Section 16130 to obtain mounting heights specified or as otherwise indicated on Drawings.

B. Install wall switch forty-four inches (44") above finished floor.

C. Install convenience receptacle fifteen inches (15") above finished floor.

D. Install convenience receptacle six inches (6") above backsplash of counter.

E. Install dimmer forty-four inches (44") above finished floor.

F. Install telephone jack fifteen inches (15") above finished floor.

G. Install telephone jack for wall telephone fifty-four inches (54") above finished floor.

3.05 FIELD QUALITY CONTROL

A. Inspect each wiring device for defects.

B. Operate each wall switch with circuit energized and verify proper operation.

C. Verify that each receptacle device is energized.

D. Test each receptacle device for proper polarity.

E. Test each GFCI receptacle device for proper operation.

F. Verify that each telephone jack is properly connected and circuit is operational.

3.06 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.07 CLEANING

A. Clean exposed surfaces to remove splatters and restore finish.

END OF SECTION

SECTION 16160

PANELBOARDS AND CABINETS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. The extent of panelboard work is indicated by drawings and schedules, and by the requirements of this section. Panelboards are defined to include the components making up the entire unit, including boxes and fronts.

B. Refer to other sections for cable, wire connectors and electrical work required in conjunction with panelboards, enclosures and cabinets.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of cabinets and panelboards of the types and ratings required, whose products have been in satisfactory use in similar service for not less than ten (10) years.

B. NEMA Compliance: Comply with National Electrical Manufacturers Association Standards Pub. No. PB1-1957.

C. UL Compliance: Comply with Underwriters Laboratories, Inc., Safety Standard UL67 for panelboards and UL Standard 50 for cabinets.

1. UL Labels: Provide panelboards and cabinets which have been approved, listed and labeled by UL.

D. NEC Compliance: Comply with National Electrical Code (NFPA No. 70), as applicable to panelboard and cabinet construction and installation.

E. NECA Standard: Comply with applicable portions of the National Electrical Contractors Associations "Standard of Installation."

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data.

B. Shop Drawings: Submit dimensioned drawings of panelboards showing accurately scaled construction layout, including but not necessarily limited to mains, bussing, gutters and terminal connections.

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle panelboards carefully to avoid damage to internal components, enclosure and finish. Do not install damaged panelboard; remove from project site.

B. Store panelboards in a clean dry space which prevents formation of condensate. Use storage space with uniform temperature and adequate air circulation. Protect panelboards from dirt, fumes, water and physical damage.

C. Do not store panelboards outdoors. If unavoidable, provide temporary enclosure to protect against weather and dirt.

PART 2 - PRODUCTS

2.01 MATERIALS AND COMPONENTS

A. General: For each panelboard indicated, provide a complete assembly of main lugs or main circuit breaker fuse switches, feeder breakers/fuses, branch breakers/fuses, terminals, bussing, gutters, boxes, neutral bar and equipment ground bar, all as needed to form a complete dead front unit.

B. Size the equipment ground bar equivalent in current carrying capacity to the incoming low voltage feeder ground conductor and suitable for brazed or approved pressure connector terminations of the ground conductors for the associated feeders, branch circuits, etc.

C. Provide main fuse or breaker and bus ratings as indicated in the panel schedule.

D. Furnish trip free branch breakers equipped with individually insulated, braced and protected connectors. Breakers to be suitably numbered on each handle, with tripped indication clearly shown by the handle position. Make provisions for future addition of breakers so that no additional connectors will be required. Use common trip in all multi-pole breakers.

E. Rate each panelboard as a complete unit equal to or greater than the integrated equipment rating shown in the panelboard schedules or as required to exceed available fault current. Obtain fault current from the local electric utility company and order panels accordingly to comply with Articles 110-9 and 110-10, 1987, NEC.

F. Furnish quick make, quick break branch breaker types with interrupting ratings as required.

G. Provide distributed phase sequence type bussing made of hard drawn copper of 98% conductivity.

H. Furnish adequate gutter space for wire size used, all per NEC.

I. Cabinets: Code gage galvanized steel with knockouts. Include fronts with flush stainless steel cylinder tumbler type locks with catches and spring loaded door pulls. Key all panelboard locks alike. Provide adjustable indicating trim front locks completely concealed when door is closed. Provide a circuit directory frame and card with a clear plastic covering on the inside of the door.

J. Install identification labels.

K. Construct panelboard interior assembly for dead front when panelboard front is removed. Provide barriers for main lugs, breakers and end of bus structure.

L. Provide Transient Voltage Surge Suppressor (TVSS) where shown on the plans.

1. The TVSS units shall be furnished and installed to provide multiple phase protection using individual line-replaceable modules and hybrid circuitry. EMI/RFI noise filtering and diagnostic LED's indicating protection circuit status. Built-in redundancy offers continuous protection even after one module is deactivated. Each replacement/ spare module is an individual suppression device providing complete high speed tight-clamping protection with EMI/RFI noise suppression and harmonic dissipation on its phase of Power System. TVSS unit shall be Levitron 57000 Series or approved equal for the main distribution panel. 52000 Series or approved equal for the branch panel.

PART 3 EXECUTION

3.01 INSTALLATION OF PANELBOARDS AND CABINETS

A. Install in accordance with the manufacturer's instructions, the applicable requirements of NEC, and in accordance with recognized industry practices to ensure that products serve the intended function.

B. Install panelboards not more than 78" from floor to the top switch or breaker operating handle.

C. Connect panelboard feeder, branch circuits, and all grounding conductors.

D. Identify all branch circuits, typewritten, in the circuit directory.

END OF SECTION

SECTION 16161

ELECTRICAL GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the contract, including General and Supplementary Conditions and General Requirements (if any), apply to the work specified in this section.

1.02 DESCRIPTION OF WORK

A. The requirements of this section apply to the grounding work specified elsewhere in these specifications.

B. The extent of grounding work is indicated on the drawings and by the requirements of this section.

1. Power system grounding.

2. Communication and signaling systems grounding.

1.03 QUALITY ASSURANCE

A. NEC Compliance: Comply with the applicable portions of the National Electrical Code (NFPA No. 70) as applicable to grounding of main service, branch and feeder circuits, conduit, equipment, separately derived systems, transformers, etc.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer=s data on wire, conduit, connectors, rods, accessories and devices required for a complete and proper building ground system.

1.05 TESTS

A. Measure ground resistance with earth test megger and install additional ground rods and conductors as required until resistance to ground complies with Code requirements.

PART 2 PRODUCTS

2.01 GROUNDING SYSTEM

A. Provide building grounding system consisting of 3/4" by 10' copper clad steel driven rods with #3/0 insulated stranded copper interconnecting conductor and connection to water main and to building structural steel.

PART 3 EXECUTION

3.01 POWER SYSTEM GROUNDING

A. Main Distribution System: From ground bus main ground electrode, provide one copper insulated ground conductor in conduit to ground bus in main service panel, to neutral of main panel and to non-current carrying parts as per NEC.

B. Circuit Grounding: Install grounding bushings, grounding studs, and grounding jumpers at pullboxes, motors and panelboards.

C. Bonding Jumpers: Provide Green insulation, sized correlated with over-current device protecting the wire, attach to grounding bushings on conduit, to lugs on boxes and other enclosures. Connection to neutral only at service main neutral bar.

D. Bonding Wires: Install bonding wire in flexible conduit connected at each end to a grounding bushing.

END OF SECTION

Appendix A SECTION 16170

MOTOR AND CIRCUIT DISCONNECTS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install motor disconnects.

B. Provide and install circuit disconnects.

1.02 RELATED WORK

A. Section 11400: Food Service Equipment

B. Section 15820: Air Distribution Equipment

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. Conform to National Electrical Code and to applicable inspection authority.

1.04 REFERENCE STANDARDS

A. Underwriters Laboratory, Inc. Annual Product Directories.

B. Classification of Standard Types of Nonventilated Enclosures for Electric Controllers, National Electrical Manufacturers= Association.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type: Square D Class 3110

B. Acceptable Manufacturers:

1. General Electric Co.
2. Siemens (I.T.E.)
3. Eaton (Westinghouse, Cutler Hammer)
4. Engineer approved equal

2.02 COMPONENTS

A. Motor and circuit disconnects shall have an Underwriters Laboratory label.

B. Single phase disconnect switches: Two pole switch.

C. Three phase motor disconnect switches: 3 pole heavy duty, non-fusible, or fusible as shown on drawings, 250 or 600 volt as required in NEMA 1 for indoor or NEMA 3R for outdoor locations.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install motor and circuit disconnect as recommended by manufacturer and as required by Code.

B. Provide and install all disconnects for mechanical equipment that do not have a disconnecting means furnished as an integral part of the equipment. Coordinate with Mechanical Contractor.

END OF SECTION

SECTION 16190

SUPPORTING DEVICES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Conduit supports

1.02 RELATED WORK

A. Section 16111: Conduit

1.03 REFERENCE STANDARDS

A. NFPA 70 - NATIONAL ELECTRICAL CODE

1.04 REGULARTORY REQUIREMENTS

A. Conform to the requirements of NFPA 70.

B. Provide products listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 CONDUIT SUPPORTS

A. Single Runs: Galvanized conduit straps or ring bolt type hangers with specialty spring clips. Do not use plumbers' perforated straps.

B. Multiple Runs: Conduit rack with 25 percent spare capacity.

C. Vertical Runs: Channel support with conduit fittings.

2.02 ANCHOR METHODS

A. Hollow Masonry: Toggle bolts or spider type expansion anchors.

B. Solid Masonry: Lead expansion anchors or preset inserts

C. Metal Surfaces: Machine screws, bolts, or welded studs.

D. Wood Surfaces: Wood screws.

E. Concrete Surfaces: Self-drilling anchors or power-driven studs.

PART 3 EXECUTION

3.01 INSTALLATION

A. Layout to maintain headroom, neat mechanical appearance, and to support equipment load requirements.

END OF SECTION

SECTION 16477

FUSES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Fuses

1.02 RELATED WORK

A. Section 16155: Motor Starters

B. Section 16160: Panelboards and Cabinets

C. Section 16170: Motor and Circuit Disconnects

D. Section 16426: Distribution Switchboards

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type: Bussmann

B. Acceptable Manufacturers:

1. Gould-Shawmut
2. Littelfuse
3. Engineer approved equal

2.02 FUSES

A. Provide fuses of the proper type and size as shown on Drawings and specified in all fused devices throughout the project.

B. Fuses shall provide current overload and current limiting protection and shall have characteristics to insure retention of positive selective coordination.

C. All fused devices shall be labeled as to type and size of fuse. Labels shall be affixed in a prominent location.

D. Where noted on Drawings, fuses shall have Underwriters Laboratories Class R rejection features.

E. Where fuse types are not shown on Drawings, they shall be as follows:

1. Fuses 601 amps and larger shall be UL Class L type.
2. Fuses 600 amps or less shall be dual-element UL Class RK1.

F. Furnish three spare fuses for each size and type fuse used on the project.

G. Furnish and install spare fuse cabinet mounted adjacent to the service entrance equipment. Cabinet shall have fuse compartments made with shelves sloping to the back, hinged front door and each compartment labeled as to fuse size and type. Cabinet shall be lockable.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses as required to meet fault current requirements.

B. Install fuses to meet duty cycle and characteristics of loads being served. Fuses that have been installed and do not suit the application are to be replaced, at no charge to the Owner, with appropriate fuses.

END OF SECTION

SECTION 16501

LAMPS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install items as listed in schedule at end of this Section.

1.02 RELATED WORK

A. Section 16502: Ballasts and Accessories

B. Section 16510: Interior Building Lighting

C. Section 16530: Site Lighting

1.03 SUBMITTALS

A. Submit manufacturer=s installation instructions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer and Type: Philips

B. Acceptable Manufacturers:

1. GE
2. Osram
3. Sylvania
4. Venture
5. Engineer approved equal

2.02 INCANDESCENT LAMPS

A. Incandescent Lamps: 2500 hour, 130 volt, extended service. Provide special lamps from longest life available in each category.

2.03 FLUORESCENT LAMPS

A. Fluorescent lamps: T8, rapid start, energy saving type, or as indicated on drawings.

B. Verify color with Architect/Engineer prior to ordering.

2.04 HIGH INTENSITY DISCHARGE LAMPS

A. Metal Halide Lamps: Mogul based lamps, phosphor-coated.

B. High Pressure Sodium Lamps: Rated life of 24,000 hours.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install lamps in accordance with manufacturer=s instructions.

B. Supply and install sizes and quantity as required for each fixture or as shown in fixture schedule.

END OF SECTION

SECTION 16502

BALLASTS AND ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Provide and install required ballasts.

1.02 RELATED WORK

A. Section 16501: Lamps

B. Section 16510: Interior Building Lighting

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. Provide ballasts that meet standards of an electrical testing laboratory and the Certified Ballasts Manufacturers' Association

PART 2 PRODUCTS

2.01 FLUORESCENT BALLASTS

A. Interior Ballasts: 120 volt, automatic reset, thermal protection with 90 percent power factor, Group A noise rating; Mark III energy saving type as manufactured by Advance.

B. Exterior Ballasts: as specified above, low temperature type, providing reliable starting to -20 degrees F. Mark III as manufactured by Advance.

C. Supply ballasts complete with heat radiators to prevent nuisance tripping.

D. Equip ballasts with capacitors and pressure relief devices to prevent interrupting.

2.02 HIGH INTENSITY DISCHARGE BALLASTS

A. Ballasts: 120 volt as indicated on drawings, of the constant wattage high power type as manufactured by Advance.

B. Select exterior ballasts for reliable starting to -20 degrees F.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide ballasts of compatible design to lamps specified.

B. Mount high intensity discharge ballasts on rubber grommets to reduce noise transmission.

C. Replace all defective or noisy ballasts.

END OF SECTION

SECTION 16510

INTERIOR BUILDING LIGHTING

PART 1 GENERAL

1.01 WORK INCLUDED

A. This Section includes supply and installation of luminaries, supports and accessories; and supply of plaster frames, trim rings and backboxes for plaster or drywall ceilings or concrete.

1.02 RELATED WORK

A. Section 16123: Building Wire and Cable

B. Section 16501: Lamps

C. Section 16502: Ballasts and Accessories

1.03 SUBMITTALS

A. Submit product data in accordance with Section 16010.

B. Submit shop drawings for luminaries indicating pertinent physical characteristics.

C. If requested by the Engineer/Architect, provide complete photometric data and heat dissipation reports from an independent testing laboratory.

1.04 COORDINATION

A. Confirm compatibility and interface of other materials with luminary and ceiling system. Report discrepancies to the Engineer/Architect, and defer ordering until clarified.

B. Supply plaster frames, trim rings and back boxes to other trades.

C. Coordinate with Division 15 to avoid conflicts between luminaries, supports, fittings, and mechanical equipment.

1.05 LUMINARY DESIGNATION

A. Refer to fixture schedule.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. As listed in the fixture schedule or Engineer approved equal.

2.02 FLUORESCENT LUMINARIES

A. Prime coat and finish in high reflectance baked white enamel, two coats minimum on exposed and reflective surfaces, giving a minimum reflectance of 90 percent.

B. Reflective plates may be 22 gauge metal.

C. Provide 20 gauge steel housing.

D. Provide hinged frames with catches; removable for cleaning without tools. Support lay-in lenses on four sides with clip ends on short dimension.

E. Provide gasketing, stops, and barriers to form light traps and prevent light leaks.

F. Design luminary to dissipate ballast and lamp heat.

G. Use formed or ribbed backplates, endplates, and reinforcing channels.

H. Provide virgin acrylic diffusers, 0.125 inches thick minimum.

I. Before ordering, confirm ceiling construction details and architectural finish for each area.

2.03 RECESSED LUMINARIES

A. Recessed incandescent luminaries: Pre-wired type with junction box forming an integral part of the assembly.

B. Supply recessed luminary complete with trim type required for ceiling system installed. Before ordering, confirm ceiling construction details and architectural finish for each area.

C. Maximum depth of recessed fluorescent luminaries 5-7/8 inches including mounting yokes or bridges. Minimum distance from backface of luminary or lens to center of lamp 2-1/2 inches.

D. Select reflector and lamp positions to provide high efficiency, and even brightness, to eliminate lamp lines.

E. Provide integral encapsulated ballasts for recessed high intensity discharge luminaries.

F. Provide thermal protection on fixture subject to high ambients or with insulation in close proximity.

2.04 EXIT LIGHTS

A. Refer to fixture schedule.

B. Battery powered fixtures shall have battery packs mounted above ceilings when fixtures are ceiling mounted.

C. Wall mounted fixture may have integral battery packs where approved by Architect or Engineer.

D. Fixtures shall be supported from grid when located in suspended ceilings.

2.05 MOUNTING CHANNELS

A. Provide wiring channel for mounting fluorescent luminaries and wiring between luminaries, suspended below mechanical piping and duct work.

B. Nominal size of channels 2-7/8 by 2-3/4 inches, 16 gauge steel, white baked enamel finish, complete with channel connectors, end closure pieces, cover pieces, mounting hickeys, luminary connectors, and joiner pieces 12 inches long to form a rigid assembly.

PART 3 EXECUTION

3.01 SUPPORTS

A. Refer to Section 16190.

B. Support fluorescent luminaries directly from building structure by rod hangers and inserts or metal angle headers supported from framing structure of ceiling suspension system.

C. Support luminaries more than 2 ft. wide by four hangers per luminary minimum independent of ceiling structure or tee bars.

3.02 RECESSED LUMINARIES

A. Install recessed luminaries to permit removal from below, to gain access to outlet or prewired fixture box.

B. Connect recessed luminary to boxes with flexible conduit and fixture wire.

C. Mounted in suspended ceiling with exposed tee bar grid system, support from the ceiling tee bar grid structure and secure thereto.

3.03 ALIGNMENT

A. Align luminaries and clean diffusers prior to final acceptance.

3.04 LUMINARY SCHEDULE

A. Refer to Fixture Schedule

END OF SECTION

SECTION 16921

MISCELLANEOUS MECHANICAL EQUIPMENT

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Miscellaneous Mechanical Equipment.

1.02 RELATED WORK

A. Section 15170: Motors

B. Section 16170: Motor and Circuit Disconnects

C. Section 16481: Enclosed Motor Controllers

D. Section 16913: Mechanical Equipment Controls

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Electrical Contractor shall furnish and install all necessary disconnect switches and starters as required. Note: Some items of equipment may be furnished as a package with starters included, reference Mechanical Specifications and all drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Electrical Contractor shall receive, uncrate, mount, connect and adjust electrical equipment furnished under all Sections of the Specifications. This includes controls, detached motors, controllers, starters and electrical elements of temperature control system.

B. Electrical Contractor shall set, align, and connect all separate motors, and furnish lubrication, start-up and test.

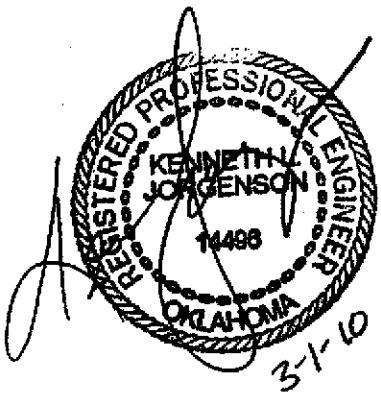
C. Electrical Contractor shall provide stencil nameplate for each unit he mounts and shall furnish and install required mountings.

D. Electrical Contractor shall complete Electrical work shown or noted on Electrical Drawings.

E. Electrical Contractor shall furnish and install power wiring associated with HVAC Temperature Control System. Refer to Division 15, Temperature Controls, Work by Others.

----------END OF SECTION----------

DIVISION SEVENTEEN – SPECIAL SYSTEMS – THELMA PARKS ELEMENTARY



SECTION 17300

CCTV SYSTEMS

PART I – GENERAL

A. PRE-K THROUGH 6TH AND 7TH – 8TH GRADE CCTV SYSTEM

The closed circuit television (CCTV) system at the Oklahoma City Public School's Thelma Parks Elementary facility shall be designed according to the following guidelines:

1. EQUIPMENT:

In an effort to facilitate managing the construction budget, the security system equipment is listed below in priority order and shall consist of a combination of the following as the budget allows:

a. Cameras w/ Monitoring Station & Recorders:

1) One camera (interior) to monitor main entry.

2) Cameras (interior) to monitor all doors that allow entry and exiting the building from the corridors.

3) One camera (exterior) to monitor staff parking areas.

4) One camera (interior) to monitor outside public entrance to media center. 5) Monitoring station to be located in reception area.

6) DVR units as required and to allow future additional cameras.

7) Digital video recorders should be located in the MDF room.

PART II – PRODUCTS

A. CLOSED CIRCUIT TELEVISION SYSTEM

1. DIGITAL CLOSED-CIRCUIT TV SYSTEMS

a. Existing cameras:

1) CCTV cameras shall be tested to verify fully operational status. Repair and Replace as required.

2) Cameras at each facility are to be UL listed and shall be compatible with existing system complying with not less than the specifications contained herein.

b. New cameras:

1) Installation of new cameras where required shall include mounting brackets and/or camera housings fully compatible with the camera provided.

2) Cameras shall have automatic iris control and shall be for interior or exterior use under normal and low light conditions of illumination and shall be provided with a weatherproof housing as specified.

3) Camera shall be mounted at or as close to the original location as possible and shall include electronic components for automatic adjustment of iris to varying levels of illumination.

4) Camera shall be CCD digital type with auto iris lens compatible with existing system. Lens shall contain a vari-focal length.

5) Power supplies shall be internally protected.

6) Cameras shall have line-lock to avoid roll during switching operations.

7) Exterior cameras shall be designed for the intended purpose and environment and all shall have the following minimum specifications:

   a) Polycarbonate clear dome

   b) Weather sealed

8) 470 TVL Color NTSC (Day) / B&W (Night Vision) switch to B&W at low light.

9) Operating Temperature range (Interior: -13 to 122 degrees F), (exterior: -50 to 140 F)

10) Light Sensitivity 0.8 lux @F1.5 (B&W - 0.1 lux @F2.0)

11) Quick change lenses

12) Line voltage 24 VAC

2. CAMERA HOUSINGS AND SUPPORTS:

a. All camera housings shall be an integral part of the dome camera and be securely attached to mounting surfaces.

b. The flush ceiling mounted units shall contain additional accessory support for acoustic ceiling installations. Wall mounted units shall be rated for support of not less than 150 lbs.

c. Weatherproof tamperproof housings shall be constructed of aluminum and finished with a weatherproof, heat reflecting paint. Housing shall be internally insulated. Cover shall be secured in place with tamperproof bolts. Housings shall be supplied with a fan, heater, sun-shield, and defroster glass if necessary for use in applied location.

3. MONITORS:

a. CCTV monitors shall be tested to verify fully operational status. Repair or replacement if required shall be in harmony with specifications outlined herein.

b. Monitors shall be mounted on shelf in equipment rack, and compatible with the total system specified herein and comply with these specifications. Provide Zenith L27W46 (or equal by Sony, RCA, or Phillips) LCD monitor wall mounted in main reception area for display of all cameras.

4. DIGITAL VIDEO RECORDERS (DVR):

a. Linux Based embedded operating system that controls the system for switching, recording and complete functionality. Control system shall be Dedicated Micros DS2 or equal with the following minimum specifications:

1) 16 video inputs (NTSC)

2) 5 matrix switch outputs

3) 24 alarm inputs

4) 30 days normal recording capacity mode, 320 GB storage.

5) Activity detection on each camera

6) Multi-screen display of live cameras on PC monitors

7) Viewing of cameras on screen in 1,4,9,16 blocks

8) 60 images/second record speed

9) Real-time playback

10) Software adjustable recording schedule

11) High resolution MP4 compression

12) Time, date, alarm, and camera retrieval filters

13) CE and FCC approved

14) Remote-View Software

15) Keyboard and mouse

16) Network Interface

17) DVD Recorder Built-IN

b. Existing and/or New Installations: Where applicable, control system components shall be mounted in existing panels and tested for fully functional status. If new components are required, they are to be mounted in a Lowell L267-77 or equivalent rack and located in the MDF/IDF Technology equipment room.

1) This rack shall include capabilities for the following: control system PC, viewing CRT, keyboard, mouse and other accessories required for a complete install.

2) Provide locking perforated front door, mounting shelves, U-181B power panel and I-180 auxiliary power strip. Equal to Mid-Atlantic or Atlas.

3) Complete software packages shall be provided to allow program adjustment of all camera settings, recording modes, viewing modes, activity detection

sensitivity, etc.

4) Interface system with District Ethernet Network to allow viewing and adjustment of system components via PC's granted access on the Network as well as PC's granted access via their internet connection. All access to the system shall be controlled via security logins/passwords. System shall allow exporting of selected video clips or single bitmap images. System shall provide digital motion detection by means of pixel change monitoring. Users shall have the ability to set desired area to monitor for pixel change to trigger alarm recording. System shall provide continuous loop recording of 5 seconds duration to allow events immediately prior to alarm recording initiation to be recorded.

PART III – EXECUTION

A. CLOSED CIRCUIT TELEVISION SYSTEMS

1. Maintain security systems and components, in accordance with equipment manufacturer's written instructions, in compliance with National Electrical Code, and with recognized industry practices, to ensure that CCTV system complies with requirements and serves intended purposes. Coordinate initial programming of system with Oklahoma City Public Schools. Provide software to Oklahoma City Public Schools for installation on other Networked PC's for control and monitoring of system.

2. Use extreme care in handling, fishing and pulling-in electronic coaxial cable to avoid damage to cable and shielding. Avoid excessive and sharp bends. Ensure manufacturer's recommended pulling tensions are not exceeded.

3. Install CCTV equipment properly to avoid causing mechanical stresses, twisting or misalignment of equipment being exerted by clamps, supports and cabling.

4. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque requirements. Where these are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and B, and the National Electrical Code.

5. Pull conductors simultaneously where more than one is being installed in same raceway.

6. All cables shall be a continuous homerun from the camera location to the equipment room. No splices will be accepted.

7. Maintain all necessary operating power systems to equipment specified in this section.

8. Maintain all cabling required for installation of complete system. All cable not enclosed in conduit shall be plenum rated.

B. GROUNDING

1. Maintain equipment grounding connections for television systems as indicated. Tighten connections to comply with tightening torques specified in UL standard 486A to assure permanent and effective grounds.

C. FIELD QUALITY CONTROL

1. Upon completion of inspection of existing system or installation of new CCTV system components, and after circuitry has been energized with normal power source, test systems to demonstrate capability and compliance with drawings and specification. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance, otherwise remove and replace with new units and proceed with retesting.

D. TRAINING

1. Provide training for Oklahoma City Public Schools on any new Closed Circuit

Television System. Contractor shall show owner all main connection points for the system, and explain the function of the system and each major component type. Contractor shall instruct Oklahoma City Public Schools in any maintenance requirements which may be the responsibility of the Owner, and procedures to be followed when new equipment is added to the MDF/IDF rooms in the future.

2. Provide information on all New Closed Circuit Television Systems including any applicable test results in the owners and operators manuals.

3. Contractor shall obtain a sign-off from the owner that they have received adequate training for the equipment.

END OF SECTION

Section 17700

Security System

PART 1 GENERAL

1.1 SCOPE AND RELATED DOCUMENTS

A. The work covered by this section of the specifications includes the furnishing of all labor, equipment, materials, and performance of all operations in connection with the installation of the Security System as shown on the drawings and as herein specified.

B. The existing security system is to remain and devices for the building addition shall be connected to the existing system.

C. The requirements of the conditions of the Contract, Supplementary Conditions, and General Requirements, apply to the work specified in this section.

D. The complete installation is to comply with Local Code Requirements and the National Electrical Code.

E. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of the International Building Code.

E. The work covered by this section of the specifications is to be coordinated with the related work as specified elsewhere under the project specifications.

1.2 QUALITY CONTROL

A. The security system that shall be installed by a company, approved by the system manufacturer, whose primary work is the installation of security systems.

B. The security system shall be provided and installed by an Oklahoma Department of Health licensed Burglar Alarm Company.

1.3 SYSTEM FEATURES

A. The system shall include the following features as a minimum:
1. Control panel unit shall include a digital split reporting alarm communicator with line seizure and anti-jam features for off premises transmissions. The digital communicator panel shall be compatible with all existing I-89 School District systems as well as receivers.
2. System shall have continuous supervision and unique identification of false and/or trouble associated with low battery voltage, grounds and external communication failures.
3. System shall allow authorized personnel to select functions such as bypassing a troubled zone, resetting of the system, aborting an alarm transmission and testing via the control keypad.
4. System shall provide an automatic transfer of operations to standby batteries should power fail.
5. System shall provide lightning and surge protection on all sources.

1.4 SUBMITTAL REQUIREMENTS

A. Submittals for systems provided under this section of the specification shall contain, but not be limited to, the following:
1. Specification data sheets on each individual system component.
2. Wiring diagrams indicating all system components, number and sizes of required conductors, interconnecting components and conduit sizes required to house-conductors.
3. Wiring diagrams shall be computer generated point-to-point type prepared specifically for this project. Typical wiring diagrams will not be accepted.
4. Provide copies of published product warranties.
5. Provide copies of installation and service certification upon completion.
6. Provide complete computer generated As-Built Documents along with a copy of the CAD file on compact disk.
7. Provide copies of maintenance manuals containing all of the above items plus maintenance requirements.

1.5 SYSTEM OPERATION

A. Actuation of any alarm shall automatically cause an alarm signal to be transmitted in a split reporting format via telephone lines furnished by the I-89 School District to the primary central receiving station located at the I-89 School District's Service Center or contracted vendor.

B. The keypad and alarm devices located in the kitchen zone shall be programmed as a separate partition to allow limited access to the kitchen area.

PART 2 PRODUCTS

2.1 Provide Security System products in sizes and capabilities indicated complying with manufacturer's information on standard materials and components designed and constructed for applications indicated.

A. Provide an Ademco, Vista 128FB Partitioned Addressable Control/ Communicator Panel or approved equal. The control panel shall be microprocessor-based and include a type HSP – 121BT1 Surge Protector Module, two (2) type SPRJ – 31 Telephone Line Surge Protectors, Telephone Communication Cords, twelve (12) VCD power supply and battery. The Security Control Panel shall be capable of supervising and controlling up to eight (8) used definable partitions up to fifty (50) devices with up to sixteen (16) keypad consoles. System shall be capable of utilizing wired, multiplexed and wireless devices to provide up to 87 zones. System shall provide up to 128 user codes with seven (7) authority levels.

B. SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads, Include surge protection for external wiring of each conductor-entry connection to components.

1. Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient –Voltage Suppression for Low-Voltage Electrical Power Circuits,"
2. Minimum Protections for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient Voltage Suppression for Low Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper –alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

C. KEYPADS

1. Provide an Ademco type 6139, Addressable Alphanumeric Keypad or approved equal. Each console shall provide a 32 character alphanumeric display and shall be programmed with custom message for each point connected to the system. All keypads shall be mounted with a flush wall mounted locking enclosure and keyed for the Ademco Locking System.
2. Provide two (2) sets of keys to be provided for each lock box.

D. CARD READERS (Access Control Panel)

A. Control Panel shall be: Topaz by Infographics (GE).

1. Topaz by Infographics (GE)
   a. TPZ-SYS-D, equipped with remote access software, HID 2000 access cards with their identity in ascending order and operable with the Infographics system.
   b. Lanyards for prox card shall be ADI.
   c. UPS capable of holding up the power supplies for each of three doors with mag locks, the Access Control Panel, Proximity Readers.

NOTE: Owner provides digital camera for Access Card Photos.

E. INTRUSION DETECTORS

1. Provide Ademco 998 MX mplx serial number or DIP switch PIR intrusion detection devices or approved equal.
2. Provide Ademco 4939 surface mount serial number contacts for roof hatches and/or doors or approved equal.
3. Door contacts on interior doors shall be utilized only where a motion device would be impractical for normal operation.
4. Door contacts will be utilized on all exterior doors.

F. WIRING

1. Provide wiring as indicated on the Final Plans and Specifications. All wiring shall be color-coded.

2. All wiring and cable installed exposed in a space, concealed inside a wall, concealed above a non-accessible ceiling or underground outside the building shall be installed in conduit. All line voltage wiring shall be installed in a conduit. All low voltage wiring installed above accessible ceiling may be installed without conduit by using cable with a jacket that is UL listed for installation in a return air plenum.
3. Plenum rated cable installed in corridors shall be installed in cable hangers.
4. All cable ties shall be plenum rated.

PART 3 EXECUTION

3.1 EXISTING / NEW FACILITIES

A. The Contractor shall arrange for a jobsite conference two (2) weeks prior to any work being performed on the existing security system.

B. The General Contractor shall take meeting minutes and distribute to all parties for record.

3.2 INSTALLATION

A. The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the Contractor attesting to the proper operation of the system.

B. All equipment and wiring shall be guaranteed against defects in materials and workmanship for a two (2) year period from the acceptance and beneficial use of the system. Emergency repairs, programming changes and additions to the system made by the I-89 School District's personnel shall not invalidate this warranty.

C. Upon completion of the installation, the electrical contractor shall provide to the Architect with a copy to the manufacturer's representative, signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the Contractor by the manufacturer.

D. Contractor will furnish upon completion a complete as-built diagram of new system for final walk through and acceptance by the I-89 School District.

3.3 INSTALLER

A. Installer shall program all information applicable to the system's operation in a contact ID split-reporting format. The programmer shall program the system so that all activations of actual alarms such as fire, smoke or intrusion will be transmitted in accordance with I-89 School District guidelines. All other supervisory activities such as test, 24-hour check-ins, only the I-89 School District personnel shall receive openings and closings.

B. The I-89 School District shall provide the programmer with the system's account number and numbers to be utilized by the receiving stations to receive alarms. The I-89 School District Office shall be responsible for the station ID numbers and all security access codes.

C. Warranty of all materials and labor for a period of one year from the date of acceptance (subject to standard exclusions).

D. Guarantee of response of a trouble call within twenty-four hours after receipt of such call.

E. Make available to the Owner an Authorized and Trained Service Representative who will provide training for the Owner's Operational and Maintenance Personnel. Training shall consist of a minimum of two sessions.

F. Prior to the end of 1-year warranty period the manufacturer's representative shall furnish the Owner with a proposal to provide an Annual Maintenance and Service Contract.

3.4 CONTROL PANEL ZONE PROGRAMMING

A. Installer shall program the panel to meet the following:
1. Zone 1 shall be reserved for fire sprinkler equipment.
2. Zone 2 shall be reserved for interior building smoke detectors.
3. Zone 3 shall be reserved for duct detectors.
4. Zone 4 shall be reserved for pull station activation.
5. Zone 5 shall be reserved for trouble / power failure.
6. Zone 6 shall be reserved for 24-hour check in.
7. Zone 7 – 9 shall be for spares and later additions.
8. Intrusion devices shall begin with Zone 10 starting at the main front lobby keypad entrances and shall be programmed with a 90-second delay and shall continue clockwise for each device per zone throughout the building.

9. All motion detectors shall be programmed as interior followers. All door and roof hatch contact shall be programmed as perimeter.

3.5 OWNER'S ACCEPTANCE OF SYSTEM

A. All walk-through testing of systems are to be completed prior to putting on line to the 911 Center and shall be conducted at a time when students are not present and there are no activities at the school.

B. Walk through testing shall include arming of system and activation of each zone to insure proper programming and installation. Copies of Samples A shall be provided to the Architect, OCMAPS Program Manager and the I-89 School District prior to walk through testing.

C. Walk through testing shall include but not limited to the following persons: system installer, designated I-89 School District personnel and a representative from the Architect.

D. Installer shall coordinate the walk through with all parties concerned and provide adequate notice.

E. During walk through designated I-89 School District personnel shall verify that system is reporting as programmed to the keypad(s). After walk through, designated I-89 School District personnel shall be responsible for verifying that signals are being properly received by both monitoring receiver stations.

END OF SECTION

Section 17720

Automatic Detection Fire Alarm System

PART 1 GENERAL

1.1 SECTION REQUIREMENTS

A. Summary: Verify the make, model and installation conditions of the existing fire alarm system. All fire alarm additions shall be added to the existing fire alarm system. Match existing devices and raceways. Contractor is responsible for providing a code compliant, fully operational Automatic Detection Fire Alarm System.

B. Submit system operating description, shop drawings, data sheets, wiring diagrams, device address list, battery calculations, and voltage drop calculations.

C. Comply with NFPA 70, The National Electric Code; NFPA 72, The National Fire Alarm Code; International Building Code; OKC Fire Marshal's Office, and all other state and local guidelines.

D. All equipment shall be UL listed in the U.S. for its installed application.

E. The Contractor shall be licensed through the Oklahoma Department of Health as an Unlimited Fire Alarm Contractor.

F. The Contractor shall be responsible for obtaining a fire alarm installation permit in the OKC jurisdiction.

G. As a minimum, actuation of any alarm shall automatically initiate the following:
1. Sound all audible alarm signals at march-time cadence and cause all visual alarm signals to flash.
2. Flash a red LED on the actuated device module at the control panel annunciator.
3. Activate the location indicator on the building annunciator.
4. Activate signals to shut-off gas fuel solenoid valves.
5. Activate signals to the mechanical control equipment to shut-down and/or reroute air handling systems.
6. Activate signals to release all magnetically held smoke and/or fire doors.
7. Activate the digital communicator to report the type of alarm and location to the remote central monitoring station.

PART 2 PRODUCTS

2.1 ALARM DEVICES

A. Manual Pull Stations: Match Existing.

B. Smoke Detectors: Match Existing.

C. Thermal Detectors: Match Existing.
1. Alarm-Indicating Device: Match Existing.

C. Central Fire Alarm Control Panel: Comply with UL 864.

E. Wires: Solid copper, with 600-V-rated, 75 deg C, color-coded insulation, Plenum Rated.
1. Low-Voltage Circuits: No. 16 AWG, minimum.
2. Line-Voltage Circuits: No. 12 AWG, minimum.

2.2 SYSTEM FEATURES

A. System shall contain not less than the following:
1) Class B wiring fire alarm system.
2) During an alarm condition, the associated device alarm LED shall flash until acknowledged (by silencing the alarm signals); this shall allow determination of location of last alarm.
3) Allow the general alarm devices to be silenced only by authorized personnel accessing a locked control cabinet, then operating an "ALARM SILENCE" switch. However, a subsequent device alarm shall reactivate the signals. Engagement of the "ALARM SILENCE" switch shall be indicated by illumination of the "ALARM SILENCED" LED and an audible trouble signal.
4) Power failures, opens, grounds, or a disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal.
5) Ground Fault detection.
6) Alarm and Trouble LED for each device.
7) Subsequent alarm (resound) feature.

8) "Dead Front" design control panel with all LED alarm, trouble, and power indicators located behind a locked transparent door.
9) Modular pluggable solid state construction.
10) Supervise all alarm-receiving-circuit and signal-circuit wiring.
11) Automatic transfer to standby batteries upon power failure.
12) Lightning and surge protection.
13) All modules shall be placement supervised.
14) Provision for remote drill and reset station; drill condition shall not shut down the HVAC system, nor shall it dial the Fire Department or 911.
15) All fire alarm panels (including transponder panels on multiple systems) shall have a ground wire (other than conduit ground) for proper operation of lightning protection.

2.3 CONTROL PANEL COMPONENTS

A. Upgrade the existing control panel to handle new areas as required and have the following:
1. Common alarm control module that allows an alarm from one (1) device to be silenced, but allows subsequent alarms from other devices to resound the alarm. Provide monitoring of all status changes within the system, system reset, signal silence, system trouble LED, alarm silenced LED, common system alarm LED, AC power on LED, trouble silence, and lamp test.
2. Alarm receiving modules Class B type. Each circuit shall be suitable for connection to manual fire alarm stations, heat detectors, approved smoke detectors, and water flow alarm switches. Upon receipt of an alarm, the receiving circuit shall lock into alarm, pulse its individual red device LED and signal the Common Control Unit. Silencing of the audible devices shall cause the flashing device LED to light steadily. The Class B device circuits shall be individually supervised for open wiring and ground faults.
3. Signal circuit modules required for each circuit, capable of supplying a minimum of 2.0 amps at 24-volt DC for the operation of polarized alarm signaling devices. Each circuit shall be provided with over current protection and shall light an individual LED trouble indicator when any of the following conditions occur:
   a) Open or shorted wiring.
   b) Operation of the over current device.
   c) Ground fault.
   d) The availability of 24-volt DC signal power at the module shall be supervised; provide to signal all devices plus pre-wire for adding two (2) future signal circuits.
4. Requires two (2) position switches to disconnect auxiliary control circuits. A system trouble condition shall be generated when an auxiliary system function (HVAC control, remote connection circuit, etc.) has been disconnected. Provide a switch module for each auxiliary circuit plus prewiring for adding two (2) future circuits.
5. Provide auxiliary relay modules for each auxiliary circuit function; each relay required to have a contact rating of 5 amps at 120-volts AC/24-volts DC. Each relay shall have one set of programmable (N.O./N.C.) SPST contacts. Provide pre-wired capacity for two future circuits.

PART 3 EXECUTIONS

3.1 INSTALLATION

A. Installation of equipment and devices that pertain to other work in the contract shall be closely coordinated with the appropriate Subcontractors.

B. Wiring Method: Install wiring in metal raceways that match the existing installation materials.

C. Provide and install the system additions in accordance with the plans and specifications, all applicable codes, and the manufacturer's recommendations. All wiring shall be installed in accordance with all applicable codes and standards. Upon completion of installation, the Contractor shall so certify, in writing, to the Owner and General Contractor.

D. Upon completion, the entire fire alarm system shall be fully tested in accordance with NFPA 72 and local Fire Department Requirements. The completion testing shall be performed by the installing licensed alarm company in the presence of the owner's representative and the local fire marshal. Once complete a copy of the Record of Completion shall be submitted to the school and the project Architect.
1) Require system manufacturer's authorized representative shall provide supervision of final system installation, panel connections, and check-out.
2) Specify Contractor shall make all arrangements and pay all fees in connection with the testing of the system.

E. Provide conduits with pull strings from the Main Control Center to each junction box location for planned future additions.

F. Smoke detector heads shall not be installed until the final testing of the HVAC system (including Test and Balance) has been completed, and all dust-creating construction has ceased. Heads installed prematurely shall be removed, cleaned, and reinstalled per manufacturer recommendations to the satisfaction of the Architect.

G. Remote relays shall be located within 25' of the item being controlled (or signaled), and shall have all wiring up to the coil supervised.

H. LABELING
1. Color code and label all conductors at control panels, junction boxes, and devices.
2. Label (not handwritten) each device (initiating, signaling, and circuit) with its associated device address inside the housing or on the connecting junction box. If exposed, label shall be visible from the floor.
3. Provide a 9" X 12" legible drawing of the building floor plan showing all fire alarm devices to be framed under tempered glass as part of the annunciator panel. Locate in main administration area and include existing building zoning.

I. CERTIFICATIONS
1. An officer of the Electrical subcontractor shall submit (through the Contractor) to the Architect and the system manufacturer's representative, a signed written statement attesting that all system equipment was installed in accordance with the code, final plans and specifications, and instructions and directives provided by the system manufacturer. The NFPA form shall be used and submitted.
2. The system manufacturer's authorized representative shall provide written certification that the system has been properly installed, tested, and is functioning properly.

END OF SECTION

Section 17730

GPS Wireless Clock System

PART I GENERAL

1.1 SUMMARY

A. Section Includes: Division 1 applies to this section. Provide GPS wireless clock system, complete.

B. Related Work Specified Elsewhere:
1. 120 volt grounded electrical outlet at transmitter location.

1.2 DEFINITIONS

A. GPS: Global Positioning System, a worldwide system that employs 24 satellites in an integrated net-work to determine geographic location anywhere in the world, and which employs and transmits atomic time, the most accurate and reliable time.

1.3 SYSTEM DESCRIPTION

A. GPS wireless clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

B. The system shall synchronize all clocks to each other. The system shall utilize GPS technology to pro-vide atomic time. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Savings Time.

C. Analog Clocks shall be synchronized to within 10 milliseconds 6 times per day, and the system shall have an internal oscillator that maintains plus or minus one second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

D. The system shall include an internal clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating time.

E. The system shall incorporate a "fail-safe" design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

F. Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

1.4 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of manufacturers latest model.

B. Transmitter and receiver shall comply with Part 90 of FCC rules, as follows:
1. This device may not cause harmful interference, and
2. This device must accept interference received, including interference that may cause undesired operation.
3. Transmitter frequency shall be governed by FCC Part 90.35.
4. Transmitter output power shall be governed by FCC Part 90.257 (b).

C. System shall be installed in compliance with local and state authorities having jurisdiction.

1.5 SUBMITTALS

A. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors and finishes of clocks.

B. Operating License: Submit evidence of application for operating license prior to installing equipment. Furnish the license, or if the license has not been received, a copy of the application for the license, to the Owner prior to operating the equipment. When license is received, deliver original license to Owner.

C. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed.

D. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

1.6 SUBSTITUTIONS:

A. Proposed substitutions, to be considered, shall be manufactured of equivalent materials that meet or exceed specified requirements of this Section.

B. Proposed substitutions shall be identified not less than 10 days prior to bid date.

C. Other systems requiring wiring and/or conduit between master and clocks, or which require connection of clocks to external electrical power supply will not be acceptable.

1.7 QUALITY ASSURANCE

A. Permits: Obtain operating license for the transmitter from the FCC.

B. Qualifications:
1. Manufacturer: Company specializing in manufacturing commercial time systems with a minimum of 10 continuous years of documented experience.
2. Installer: Company with documented experience in the installation of commercial time systems.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.9 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Coordinate installation of GPS receiver for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

1.10 SYSTEM STARTUP

A. At completion of installation and prior to final acceptance, turn on the equipment, ensure that all equipment is operating properly, and that all clocks are functioning.

PART 2 PRODUCTS

2.1 MANUFACTURER:

A. GPS wireless clock system shall be manufactured by Primex Wireless, Inc., N3211 County Road H, Lake Geneva WI 53147 (800) 537-0464 FAX (262) 248-0061 www.primexwireless.com, Rauland, Simplex, Dukane or approved equal.

2.2 SEQUENCE OF OPERATION

A. Transmitter Operation: When power is first applied to the transmitter, it checks for and displays the soft-ware version, then it checks the position of the switches and stores their position in memory. The transmitter then looks for the GPS time signal. Once the transmitter has received the GPS time, it sets its internal clock to that time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock every time it receives valid time data from the GPS.

B. Analog Clock Operation:
1. When the batteries are inserted into the clock: A) Press the red button when the red second hand is at the 12:00 position. At this time the microprocessor will lock in the location of the second hand. B) After the red second hand has passed over the minute hand (first second hash mark after minute hand), press and release the red button. At this time the microprocessor will lock in the location of the minute hand. The microprocessor then assumes the location of the hour hand.

2. After the red button has been pressed twice, the micro processor will start searching the channels. It will start at channel No. 1 and proceed one by one until it either decodes a valid signal or reaches channel No. 16. If no signal is detected the receiver will be shut off and will try again later. If a signal is received, the micro processor will store the channel number, set the clock to the receive the time. For the next minute the clock will beep every time that it receives a valid time signal. If the clock is in a good signal area it will beep once a second. If the clock beeps every few seconds, the clock is in a marginal signal area. Analog clocks can operate in marginal signal areas, but battery life will be about 25 percent shorter.
3. After initial set, the clock will shut off the receiver. On a pre-scheduled basis, the microprocessor will turn the receiver back on and starting with the stored channel, it will again look for a valid time signal. However, the beeper will not operate.
4. If the clock has not decoded a valid time signal for seven days, then it will go back to a double-step mode. Non-signal reception can be caused by low battery voltage. If this occurs, replace the batteries.

2.3 EQUIPMENT

A. General: The clock system shall include a transmitter, a roof or window mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. Transmitter: Primex Wireless Model FM-72, consisting of wireless transmitter with GPS receiver. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.
1. Transmission:
   a. Frequency Range: 72.100 to 72.400 MHz.
   b. Transmission Range: one mile, open field.
   c. Radio technology: narrowband FM
   d. Number of channels: 16
   e. Channel bandwidth: 20 kHz maximum
   f. Transition mode: one-way communication
   g. Data rate: 2 KBps
   h. Operating range: 0 degrees C. to 70 degrees C.
2. Transmitter:
   a. Transmitter output power: +26 to +30 dBm
   b. Frequency deviation: +/- 4 kHz
   c. Transmitter power requirements: 120 VAC 60 Hz
   d. Internal power requirements: 5 VDC
   e. Carrier frequency stability: +/- 20 ppm
3. Transmitter shall have 16 selectable channels to assure interference-free reception.
4. Transmitter shall have the following switches:
   a. Time zone adjustment switches for all time zones in the world. Includes all US time zones: Eastern, Central, Mountain, Pacific, Alaska and Hawaii.
   b. Daylight Saving Time bypass switch.
   c. 12-hour or 24-hour display.
5. Transmitter housing shall be black metal case, 16-3/4 inches by 12 inches by 1-7/8 inches in size.
6. Antenna shall be 46 inches high, commercial type, mounted on top center of transmitter housing. Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.
7. Transmitter housing shall incorporate a display which shall include the following:
   a. Time readout
   b. AM and PM indicator if 12-hour time display is set
   c. Day and date readout
   d. Indicator for daylight savings or standard time
   e. LED which shall flash red in event of reception problem
   f. GPS reception indicator
8. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.

C. Power supply: Model Number: 140003 Input: 120 volt AC 50/60 Hz, 0.4 amp. Output: 9 volt DC, 1.5 amp.

D. GPS Receiver: Model Number Q11695, GPS roof mounted, with 15 foot cable attached (additional Primex Wireless extension cable available: 50, 100, 150, 200 foot).
1. The GPS Receiver shall be a complete GPS receiver including antenna in a waterproof case, 3-7/8 inches by 4-3/16 inches by 2 inches, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure.

E. Traditional analog clocks: Primex Wireless analog clocks, 12-1/2 inch diameter or 16 inch diameter as selected, color and finish as selected from manufacturer's standard colors and finishes. Analog clocks shall be

wall mounted, and 12-1/2 inch diameter clocks shall have polycarbonate frame and polycarbonate lens. Face shall be white. Hour and minute hands shall be black. Analog clocks shall be provided with red sweep second hand.

1. 12-1/2 inch analog clocks shall be battery-operated, and shall have 5-year battery life.
2. Analog clocks shall be capable of automatically adjusting for Daylight Saving Time. An on-off switch located on the transmitter shall disable this function if desired.
3. Time shall be automatically updated from the transmitter 6 times per day.
4. Analog clocks shall remember the time during changing of batteries.
5. 12-1/2 inch analog clock lock: Tamper-proof/theft resistant hangers and slots in the backs of the analog clocks.
6. Provide 2 alkaline D-cell batteries with each 12-1/2 or 16-inch analog clock.
7. Analog clock receivers shall be as follows:
   a. Receiver sensitivity: >-110 dBm
   b. Receiver power: two alkaline D-cells
   c. Antenna type: internal
   d. Antenna gain: -7 dBd
8. If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded.
9. Analog clock faces shall bear Owner's logo as indicated.

F. Wire guards: Provide one for each analog clock as follows:
1. Model No. 14131, 14 by 14 inch size, for nominal 12-1/2 inch diameter analog clocks.
2. Model No. 14123, 18 by 18 inch size, for 16 inch diameter analog clocks.

F. Cable Connection Sealant: Radio Shack Coaxial Cable Connector Sealant 278-1645, or approved electrical grade silicone sealant.

H. Additional Equipment
1. Wireless receiver switches: Switches shall receive time packets from the master transmitter and relay the synchronized time to the satellite transmitter connected to it. The unit shall include the following:
   a. Antenna mounted on top of the switch housing, 11-1/2 inches long
   b. Power Supply:
      Input: 120 VAC 50/60 Hz, 0.4amp
      Output: 9 volt DC, 1.5 amps
   c. RS 232 data cable, 5 feet long
   d. Daylight Saving Time bypass switch
   e. Dimensions: 4-1/4 inches long, 5-3/4" wide, 1-1/4 inches deep
   f. Weight: 12 ounces
   g. Operating range: 32 degrees F to 158 degrees F (0-70 degrees C)
2. Satellite transmitters: Satellite transmitters shall receive the signal from the wireless receiver switches and transmit the signal to the devices in its vicinity, which are out of range from the master transmitter. The unit shall include the following:
   a. Antenna mounted on top of the housing, 46 inches long
   b. Power Supply:
      Input: 120 VAC, 50/60 Hz, 0.4 amp
      Output: 9 volt DC, 1.5 amps.
   c. 6 foot cord
   d. Approximately one Watt transmission
   e. 72 MHz frequency
   f. 16 selectable channels
   g. Time zone adjustment switch
   h. LCD display showing time, date and signal verification
   i. Housing: black metal casing:
   j. Dimensions: 16 inches wide by 12 inches deep by 1-7/8 inches high
   k. Weight: 7-3/4 pounds
   l. Operating range: 32 degrees F to 158 degrees F (0-70 degrees C)

PART 3 EXECUTIONS

3.1 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

B. Verify that 120 volt electrical outlet is located within 6 feet of location of transmitter, and that outlet is operational and properly grounded.

3.2 INSTALLATION

A. GPS Unit: Install on roof in location indicated, in clear view of the sky. Install unit in location free from standing water, and above accumulations of leaves or debris. Seal cable connection to GPS with cable connection sealant. Any added cable lengths must be protected from outside elements.

B. Transmitter:
1. Locate transmitter where indicated, a minimum of 2 to 3 feet above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls. The preferred transmitter location for best transmission coverage is centrally located on the top floor of the building.
2. Attach receiver to transmitter using cable.
3. Connect antenna to transmitter, using care not to strip threads.
4. Connect power supply to the transmitter.
5. Set the channel number on the display to correspond to the FCC license.
6. Plug power supply into electrical outlet.

C. Analog clocks: Perform the following operations with each clock:
1. Install D-cell batteries.
2. Set clock to correct time in accordance with manufacturer's instructions.
3. Observe analog clock until valid signals are received and analog clock adjusts itself to correct time.
4. Install the analog clock on the wall in the indicated location, plumb, level and tight against wall. If using 12-1/5 inch clock, attach using clock-lock hanging method and suitable fasteners as approved by clock manufacturer.

D. Wire guards: Secure to wall, using approved theft-resistant fasteners.

E. Receiver switches: Locate as required to provide complete coverage of the area designated for each switch. Install the receiver switch in the location or locations indicated, and secure to supports using fasteners suitable for the surface to which it is attached.
1. Align the antenna vertically.
2. Set receiver switch to the same channel number of the transmitter it will be receiving its signal from.

F. Satellite transmitter: Install within 5 feet of the receiver switch and connect using the supplied cable.
1. Set the satellite transmitter to the channel as indicated on the approved submittal and FCC license.
2. Set switch B for time zone offset from UTC.
3. Set switch #3 to down position.

3.3 ADJUSTING

A. Prior to final acceptance, inspect each clock, adjust as required, and replace parts, which are found defective.

3.4 CLEANING

A. Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by clock manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.5 DEMONSTRATION

A. Provide training to Owner's representative on setting and adjusting clocks, replacing batteries and routine maintenance.

3.6 PROTECTION

A. Protect finished installation until final acceptance of the project.

END OF SECTION

Section 17740

Telephone System

PART 1 GENERAL

1.1 ELECTRICAL DESIGN COORDINATION

A. Modify existing telephone cabinet and associated wiring as indicated below.

B. Install new telephone board for new data cabling for interfacing with security, intercommunications, fire alarm data, energy management, and other building systems requiring phone lines. Interphase these systems between the existing telephone cabinet and the new.

C. Work covered in this section includes:
   a. Restoring existing telephone service to existing conditions.
   b. Wiring for equipment covered in this section.

   The flowing work is not covered in this section and will be done by other subcontractors:
   a. The wiring to related systems such as fire alarm and energy management systems.
   b. All new communications cabling of security systems.
   c. Data infrastructure cabling of computer and voice communications in all rooms except those mentioned in this section.

D. Comply with Section 16100 and Section 16143 criteria. Coordinate millwork at Administration reception counter to achieve access to telephone receptacle and routing of phone cords.

E. Provide two (2) dedicated telephone lines for fire alarm panel, one (1) line for the primary and one (1) line for the secondary service line. Provide one (1) dedicated line for elevators (all elevators in the building will share this line). Provide two (2) dedicated lines that can be shared with the security panel, energy management and two (2) 911 hotphones.

F. These telephone lines will run to the new "TB" (Telephone Board) in room 025.

1.2 TELEPHONE RECEPTACLE LOCATIONS

A. See Section 16140 criteria.

B. Provide two (2) telephone lines in the Administrative area, behind the front desk in the reception area, that can be utilized for failsafe and for 911.

C. One (1) can use the same line as the energy management line and one (1) can share with the security system.

1.3 SECURITY SYSTEM

A. Design for necessary components of security system.

B. See Section 17700 design criteria.

1.4 FIRE ALARM SYSTEM

A. Provide necessary components for the fire alarm system and sprinkler system's flow switch.

1.5 ENERGY MANAGEMENT SYSTEM

A. Provide necessary components to accommodate the energy management system.

1.6 ELEVATORS

A. Provide necessisary components to accomidate elevator.

PART 2 PRODUCTS

2.1 CONDUITS & BOXES

A. Comply with Section 16130 design criteria.

B. Minimum 3/4" conduit size required.

C. Bushed ends at backboard locations.

2.2 COVERPLATES

A. For onsite telephone wire only if any exist.

B. Comply with Sections 16140.

C. "JUMBO" size brushed stainless steel cover with bushed center hole for telephone outlet covers.

D. "JUMBO" size blank covers at all unused telephone boxes.

2.3 EQUIPMENT CABINETS

A. "Square-D" Class 6650 lockable cabinet to hold required spare parts and tools.

B. Locate at Main Backboard.

PART 3 EXECUTION

3.1 SERVICE ENTRANCE

A. Minimum 4" underground conduit with wide-sweep elbows [maximum of four (4)] from utility tie-in source to the telephone backboard.

B. Terminate conduit with smooth insulated bushed end at edge of backboard (minimum 16" A.F.F.).

3.2 GROUNDING

A. 6" long X 1" high X 1/8" thick copper grounding bus on each backboard. Provide minimum twelve (12) grounding set screws.

B. #1/0 AWG insulated copper ground conductor in a 3/4" rigid conduit from each backboard to the main electrical service ground bus and bond.

3.3 BOX MOUNTING

A. For onsite telephone wire only.

B. In accordance with Section 16100 criteria, vertically with bottoms of boxes at 16" A.F.F., set on top of second CMU course. Flush-mount with wall surfaces.

C. Grout fill around all boxes in CMU partitions to solidly anchor in place.

D. Do not position boxes between differing wall materials.

E. Offset telephone boxes and other device boxes on opposite faces of walls a minimum of 6"; no back-to-back devices are allowed.

3.4 COVERPLATES

A. For onsite telephone wire only.

B. Install with pair of matching screws, box snug to finished surface on all sides.

C. Install plumb and level; adjust box as required.

3.5 CONDUITS

A. For onsite telephone wire only.

B. Each telephone receptacle box shall have its own conduit run to top of partitions and turned out above the ceilings.

C. In the (MDF), neatly terminate conduits above the ceiling and at uniform height 4" inside the perimeter of the backboard with smooth insulated bushed ends and secure conduits to wall construction.

3.6 IDENTIFICATION

A. Label the outlets in the Administrative area for the emergency 911 lines.

3.7 TIE-INS

A. Provide for telephone system vendor tie-in to building security system, intercom system, fire alarm systems, data systems, and energy management systems.

END OF SECTION

SECTION 17745

DATA INFRASTRUCTURE

PART 1 GENERAL

1.01 DATA SYSTEMS

A. This document defines the cabling system and subsystem components to include cable, termination hardware, supporting hardware, and miscellaneous items required to furnish and install a complete cabling infrastructure supporting voice and data. This design will be used for all K-12 educational facilities. This document describes cable routing for classrooms, labs, administrative area, technology support areas and any other area that requires cabling and also, shows diagrams of typical classrooms layouts, parts, labeling etc. to enhance clarification.

B. A data drop can be used for both data and/or voice. Refer to the Section 16740 for specific information about telephone. The Data and Telephone Sections will be cross-referenced.

1.02 STANDARDS

A. The copper based network infrastructure will be an Enhanced Category 6 (CAT- 6) compliant Structured Cabling System with a ten (10) year minimum service and product warranty. Contractor will configure and install this equipment as to provide a configured and working Category 6, drop(s) integrated into the Wide Area Network of the I-89 School District.

B. Wiring Scheme will be TIA/EIA 568-B compliant.

C. CAT-6 media twist cable runs in classrooms and offices or visible to those who use the building will be either in the walls at drop locations with flush mount faceplates (whenever possible) or in a horizontal surface mount around perimeter of the room.

D. Each wall plate will have its own conduit run to the top of partitions and turned out above ceiling, including the blank wall plates.

E. All raceway used on exterior will be mechanically fastened and of metallic construction where accessible to students. J-Boxes will be mechanically fastened.

F. All work will be designed in accordance with the BICSI TDMM, and will be installed in accordance with the BICSI CIM. In addition, all work will conform to:
1) 2002 NEC (or most current) including 110-3, and 800-6.
2) ANSI/TIA/EIA Building Wiring Standards.
3) OEM installation directions.
4) Applicable State and local code.

G. All floor and wall penetrations will be fire and smoke stopped to restore the structures to the original fire or smoke rating by design, code and standard. Preexisting penetrations will be fire or smoke stopped if used for cable routes. All fiber optic cables to annex or outer buildings will be buried in conformance with the standards listed in paragraph F.

H. Pathways will be installed using wide J-hooks with minimum bend radius. Wire bridle rings or cable ties will not be acceptable. In the classroom, small bundle support wide J-hooks may be used to attach to ceiling wire support IAW 1997 TIA/EIA 569-A Standard. Complete building cabling pathways will be installed, where deemed appropriate, for future building structured cabling systems requirements on those routes required by this RFP. J-hook load will not exceed 40% of capacity.

I. Plenum CAT-6 Belden Media Twist Bonded-Pair Network Cable 1874A or equal will be utilized. Cable jacket color of red.

J. Fiber optic cable will run between the Main Distribution Room (MDF) and Remote Distribution Room (IDF) (not including Lab, Media Room, and Trade and Industrial Closets) for telephone. The slack will be coiled up above the ceiling in the IDF.

K. All connections between wiring closets will be multimode 50/125 µm duplex fiber optic.

L. Each fiber optic cable run will be a minimum of 6-fiber strands.

M. Each fiber optic cable connections will be terminated with SC connectors to TIA/EIA specification and installed in fiber optic rack mount termination cabinets.

N. UTP modules will be Panduit Mini-Com TX-6 PLUS, part number CJ688TPRD, Red in color.

O. Technology support areas to be located no further than 300' from the jack location in classroom to the patch panel in the technology support area. This assumes the use of Belden or equal CAT-6 media twist cable, which allows 10% over run from the CAT-6 standard for patch and classroom runs. If distance or the wire run is anticipated to exceed 300', a separate technology support area must be provided, or alterative distribution method must be identified.

P. If the Panduit part that is specified is not available then the Panduit replacement part is acceptable.

Q. Raceway, faceplates and J-Boxes will be Ivory in color and matched as closely as possible.

R. Two (2) 4" conduits will extend to facility exterior for telephone and data communications from the MDF to the property line location designated by the OCMAPS Program Manager.

S. Generally, the standard articulated will be used in both new construction and remodeling.

T. Existing CAT-6 cable may be utilized but it is the responsibility of the contractor to ensure the infrastructure is certified to these specifications. If existing CAT-5 cable exists it will be removed unless directed otherwise by the OCMAPS Program Manager.

1.03 DESIGN REQUIREMENTS

A. Technology Support Areas

1. MDF is the central equipment room for the school site. Some schools may have some IDF. The environmental controls for the MDF and IDFs should be separate from building system for year-round operation.
2. If an IDF is required and utilized, provide two (2) 2" conduits between the MDF and the IDF.
3. If an IDF is required and is utilized, run one (1) bundle - 12 strands of multi mode 50/125 µm fiber optic duplex home runs to the MDF and terminate with SC connectors.
4. Must be secured to designated I-89 OKCPS staff, with a single common key between all technology support areas for all schools in the District.
5. FLOOR RACK
   a. A 19" Standard Rack (7' Aluminum), Panduit part number CMR19X84, Chatsworth part number 46353-703, B-Line part number SB556084XU or equivalent will be placed in the MDF. Two (2) or more racks will be placed in the MDF for schools with classroom totals 50 or less and three (3) or more racks with classroom totals over 50.
   b. One (1) additional rack will be placed in the IDF (Used when cable lengths would exceed ANSI/TIA/EIA Standards).
   c. Racks in the MDF and IDF will be placed as close to the demarcation point as possible, allowing BICSI standards compliant space between walls and walkways.
   d. Racks will be ganged together with vertical cable manager centered between and on each end (Panduit part number NCMV8, Chatsworth part number 30095-703, B-Line part number SB-571-66D-084 or equivalent).
   e. Two (2) vertical Power Distribution Units (PDU) will be mounted to the rear of each rack. The PDU will have ten (10) 5-15R outlets and one (1) 5-15P plug with at least an 8' cable.
   f. Rack will be securely attached to the floor.
   g. All racks will be grounded to the telecommunications ground bus bar in accordance with the grounding section of this document.
6. TECHNOLOGY SUPPORT AREA WALL LININGS

a. At least one (1) closet wall should be lined with trade size ¾" ACgrade plywood 8' high. Plywood should be void free and either fire rated or treated on all sides with at least two (2) coats of fireresistant paint.

b. Walls, floors and ceiling should be treated with coatings that minimize dust and static electricity.

c. Walls will contain ladder cable trays to facilitate management, routing and distribution of cables.

7. TECHNOLOGY SUPPORT AREA EQUIPMENT RACK CLEARANCES

a. Allow a minimum of 3'-4" (1m) of clear working space from equipment and cross-connect fields.

b. Equipment racks should be provided within the Technology Support Areas. Allocate a space of at least 32" (80cm) deep and 7'-6" (2.3m) high for each rack. Provide space for an aisle of at least 32" (80cm) wide in the front and in the rear of each equipment rack.

8. TECHNOLOGY SUPPORT AREA ELECTRICAL CIRCUITS

a. Dedicated 120V nominal, non-switched, ac duplex electrical outlet receptacles, (NEMA 5-20R) each on a separate branch circuit per rack, will be provided for equipment power. These receptacles should be rated at 20A.

b. Identified and marked convenience duplex non-switched outlets will be placed on each wall which may be provided on a single but separate branch circuit.

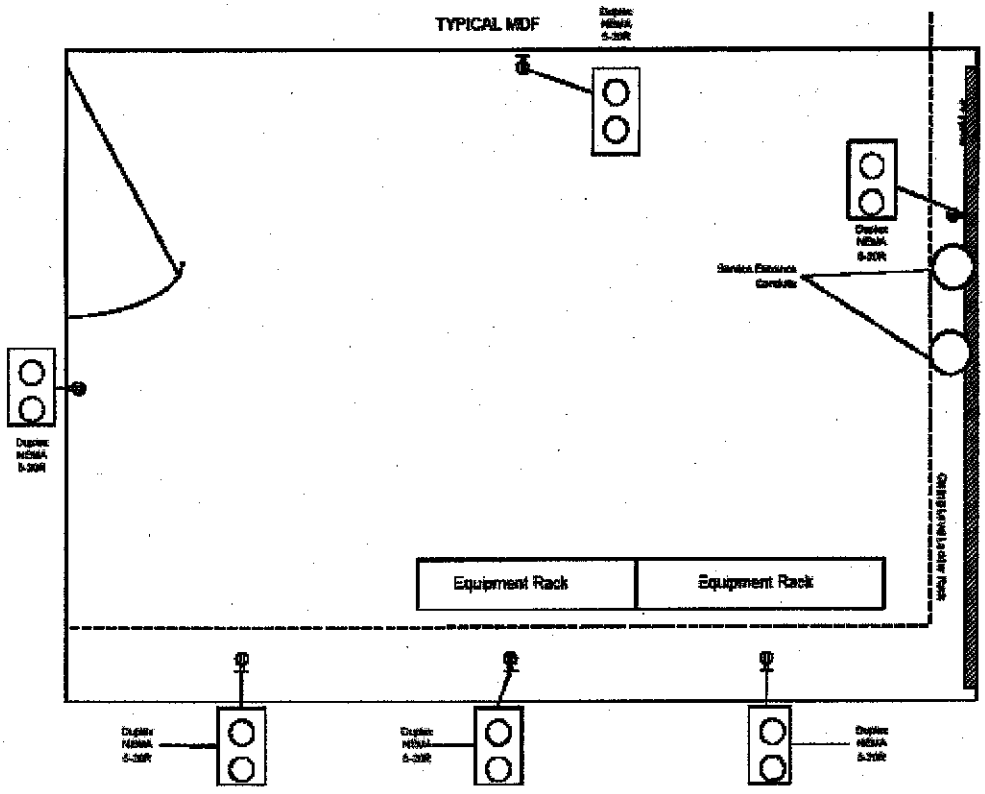


Fig. 1

9. PATCH PANEL

a. These specifications require sole use of Panduit patch panels for continuity, expansion and ease of maintenance. No substitution will be accepted.

b. Forty-eight (48) port copper patch panels in the MDF and IDF will be Panduit part number UICMPPA48BL.

c. A fiber patch panel (Panduit part number FRME2) will be in the MDFA rack in the MDF and a fiber patch panel (Panduit part number FRME1) will be in a rack in each IDF.

d. The MDF fiber patch panel will have six (6) Adapter Panels loaded with blue SC duplex adapters with ceramic sleeves (Panduit part number FAP6WBUDSCZ).

e. The IDF fiber patch panel will have one (1) Adapter Panel loaded with blue SC duplex adapters with ceramic sleeves (Panduit part number FAP6WBUDSCZ) and two (2) blank adapter panels (Panduit part number FAPB).

f. Terminate fiber cables properly with adequate slack left at both entrance location and termination unit.

g. MDF/IDF fiber optic strands will be terminated in the following order:

Position	Color
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

h. Equipment racks MDF-A and MDF-B will house the copper patch panels for horizontal cabling for all rooms that are within the 300' cable limit (not including Labs, Media Rooms and the Trade and Industrial area).

i. All copper and fiber patch panels will be located in MDF-A, but larger schools will require some copper patch panels to be placed in MDF-B to accommodate all equipment listed in the rack order of Figure 2.

j. If the copper patch panels utilized in MDF-A exceed 14U then install the remaining patch panels in MDF-B.

k. All MDF equipment will be rack mounted in the order as specified in Figure 2.

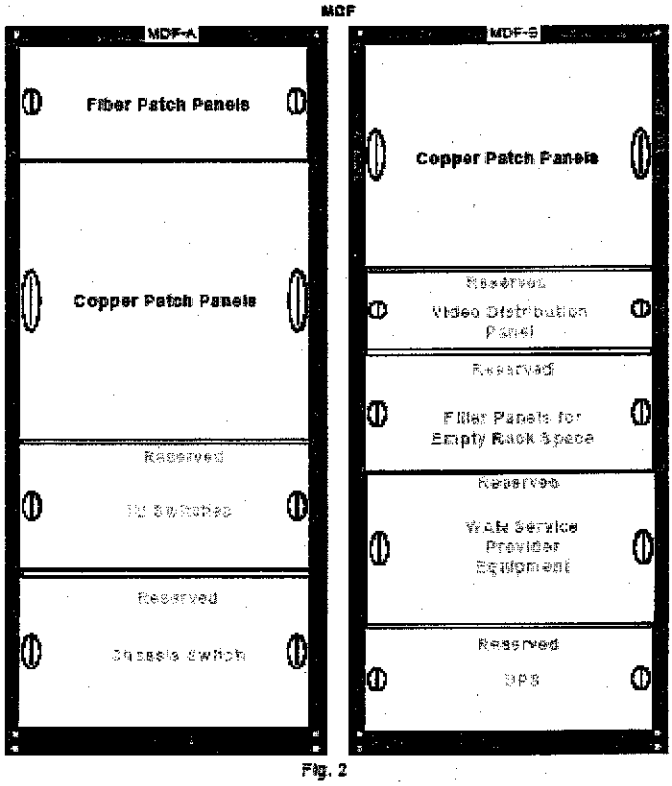


Fig. 2

l. Equipment racks in the IDF's will house the copper patch panels for horizontal connectivity for the closest room excluding Labs, Media Rooms and the Trade and Industrial Area.

m. All IDF equipment will be rack mounted in the order as specified in Figure 3.

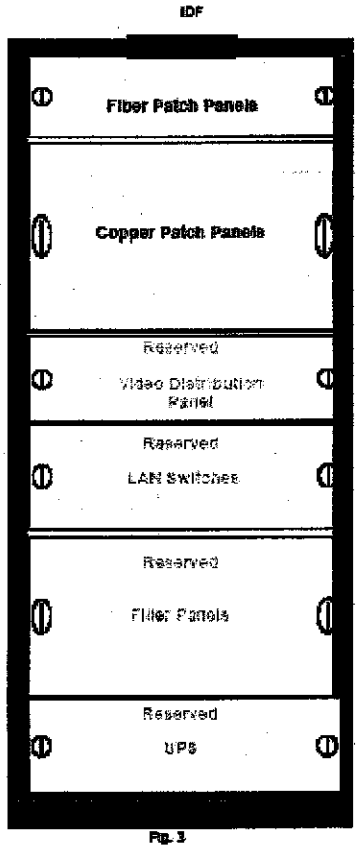


Fig. 3

B. CLASSROOM CABLING

1. Six (6) CAT-6 media twist cable in each classroom and will be terminated in the closest MDF or IDF, three (3) drops in one corner and three (3) in the other (see Figure 4).
2. An additional six (6) CAT-6 cable will run from the MDF or IDF to each classroom with 100' slack, coiled up in the ceiling in the classroom for future AP.
3. Two (2) blank wall plates with matching color blank modules for future network drop locations will be placed in each classroom as shown in Figure
   a. Coax will be placed opposite door and adjacent to the white board.
   b. See Figure 4 for placement locations.

Typical Classroom

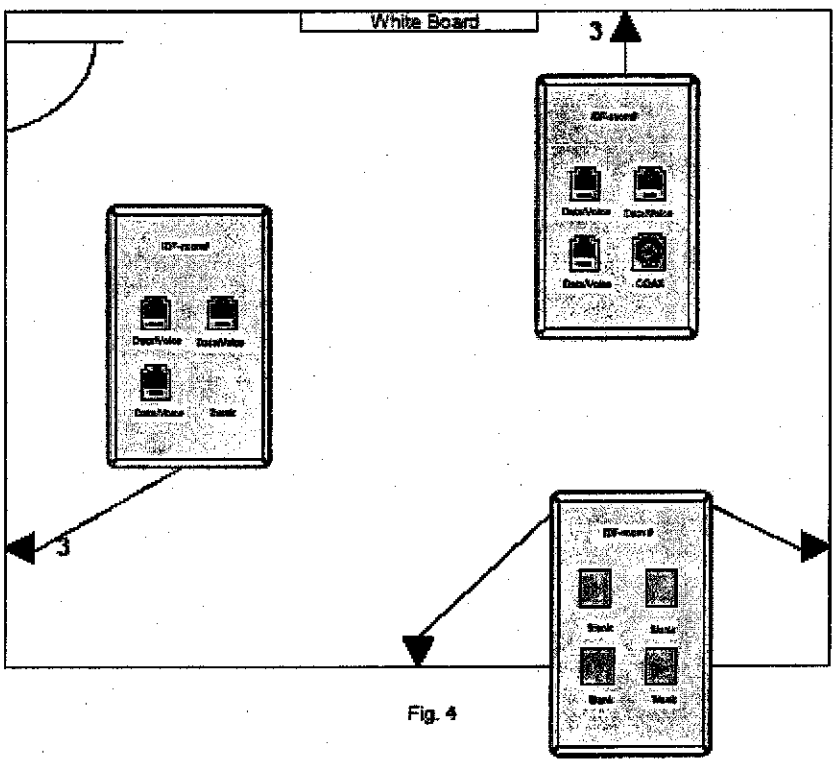


Fig. 4

C. LABS, MEDIA CENTER, TRADE AND INDUSTRIAL CLASSROOMS (Including Business Education and Career Technology classrooms)

1. Equipment Closet:

a. A network closet will be placed in the media center, one (1) closet in each lab and one (1) closet in the Trade and Industrial Area. The door will be located in the hall to discourage anyone from trying to use it for other reasons besides network equipment. The door will be ventilated.

b. The closet will be at least 70" wide X 40" deep allowing enough room to manage the cables in the rack.

c. Must be secured to Technology staff only, with a single common key between all technology support areas for all schools in the District.

d. A 19" Standard Rack (7' Aluminum), Panduit part number CMR19X84, Chatsworth part number 46353-703, B-Line part number SB556084XU or equivalent will be placed in each lab/media room closet.

e. Vertical cable manager will be mounted on both sides of the rack (Panduit part number NCMV8, Chatsworth part number 30095- 703, B-Line part number SB-571-66D-084 or equivalent).

f. One (1) Power Distribution Unit will be mounted to the rack (2 AMPS draw anticipated). The PDU will have ten (10) 5-15R outlets and (1) 5-15P plug with at least an 8' cable.

g. The rack will be securely attached to the floor and grounded to the telecommunications ground bus bar in accordance with the grounding section of this document.

h. Forty-eight (48) port copper patch panels in the closet will be Panduit part number UICMPPA48BL.

i. A fiber patch panel in the closet will be Panduit part number FRME1.

j. This fiber patch panel will have one (1) Adapter Panel Loaded with blue SC duplex adapters with ceramic sleeves (Panduit part number FAP6WBUDSCZ) and two (2) blank adapter panels (Panduit part number FAPB).

k. The rack order is shown in Figure 5.

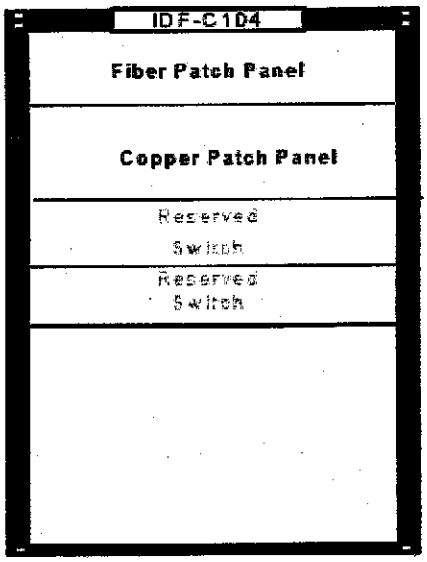


Fig. 5

2. LAB AND MEDIA CENTER CABLING

a. One (1) bundle – 6-strands of multimode 50/125 µm fiber optic duplex cable will run from the MDF and terminated with SC connectors in the equipment closet.

b. MDF/IDF fiber optic strands will be terminated in the following order:

Position	Color
12	Blue
13	Orange
14	Green
15	Brown
16	Slate
17	White

c. Three (3) CAT-6 drops and one coax will be located in the wall plate beside the white/chalk board at standard gang height opposite the entry door. The three (3) CAT-6 drops will be terminated in the patch panel in the lab equipment closet and the coax will be terminated in the MDF

d. There will be a total of 30 CAT-6 drops in the lab.

e. On opposite walls group four (4) quads of three (3) Data/Voice drops. This placement will be determined by room dimensions and furniture size.

f. Two (2) blank wall plates with matching color blank modules for future network drop locations will be placed in each lab and media room.

g. See diagram below (Figure 6) for placement locations.

Typical Computer Lab

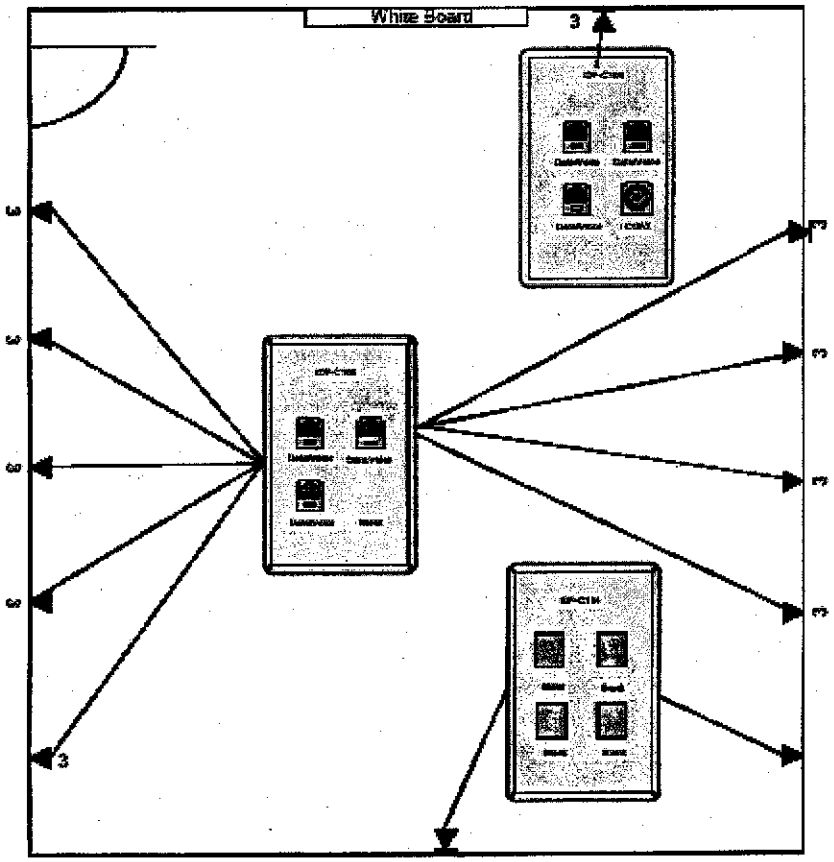


Fig. 6

3. TRADE AND INDUSTRIAL AREA CABLING

a. One (1) bundle – 6-strands of multimode 50/125 µm fiber optic duplex cable will run from the MDF and terminated with SC connectors in the Trade and Industrial equipment closet.

b. MDF/IDF fiber optic strands will be terminated in the following order:

Position	Color
18	Blue
19	Orange
20	Green
21	Brown
22	Slate
23	White

c. The following list contains the number of CAT-6 drops for each area. These drops will be terminated in the Trade and Industrial closet:

1) Agriculture (AG Mechanics and Animal Science) – 15 drops
2) Agriculture (Horticulture) – 15 drops
3) Automotive – 15 drops
4) Cosmetology - 10 drops
5) Health Science Technology - 20 drops
6) Marketing/I.C.E. – 10 drops
7) Graphic Communication Lab – 30 drops
8) Construction or Welding Lab -10 drops
9) Video production - 2 drops
10) Office - 2 drops per office

d. Placement of the drops depends on room layout/ dimensions and furniture placement.

D. ADMINISTRATIVE OFFICES
1. Three (3) CAT-6 drops in each administrative office will be terminated in the closest MDF or IDF.
2. Placement of the drops depends on room layout/ dimensions and furniture placement.

E. SCIENCE LABS
1. Five (5) CAT-6 drops plus one (1) drop for each demonstration table in each lab and will be terminated in the closest MDF or IDF.

F. ALL OTHER SPACES
1. Reference Ed Specifications for specific number of drops and terminate in the closest MDF or IDF.

G. FACEPLATES
1. Faceplates will be single gang, horizontal sloped, holding up to four (4) Mini-Com Modules. (Panduit part number UICFPHSE4IW).
2. Outlets will provide a means of supporting modular jacks during termination.
3. Module Icons – Contractor will install the following module icons for each classroom/administration work area:
   a. One (1) yellow voice module icon, Panduit part number UICIPYL -C next to the teacher's desk.
   b. Provide all remaining drops in work area with green data module icon, Panduit part number UICIDGR -C.

H. LABELING
1. Labeling scheme per classroom will contain assigned identifiers for space, panel and port per TIA/EIA 606 standards. All labels must be machine generated and inserted into faceplate then secured with clear plastic cover.
2. All faceplates will denote the MDF or IDF room number on each faceplate. The individual CAT-6 modules will be identified with the classroom number followed by the port/cable number. For example, the label for the faceplate is IDF-D100 which means the cables in this faceplate are terminated in network closet D100. Figure 7 shows the detailed labeling required for a faceplate for classroom C104.

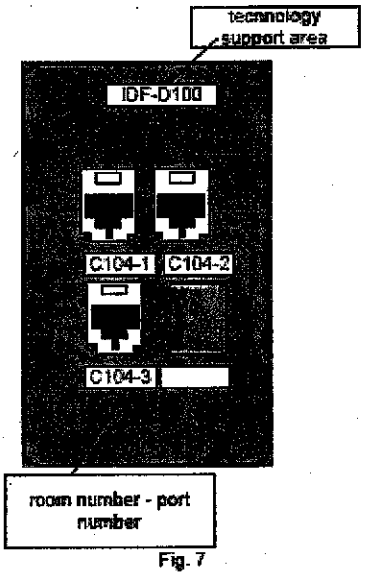


Fig. 7

3. LABELING MAIN EQUIPMENT ROOM (MDF)
   a. All MDF equipment racks will have a visible label using the following convention "MDF-A" which would represent equipment rack A and "MDF-B" would represent equipment rack B and so on as shown in Figure 2.
   b. Ports on the patch panels will be grouped and labeled in order from left to right, top to bottom.

c. The following Figure 8 explains how all copper patch panels will be labeled. Each port will be labeled with "Room Number – Cable Number". For example, classroom A104 would have ports labeled A104-1, A104-2,... A104-6 and administrative rooms are labeled B01-1, B01-2, B01-3, B02-1, B02-2, etc.

Fig. 8

d. Fiber patch panels are labeled similar to the copper patch panels. The label represents where the fiber is terminated on the other end of the cable.

e. The following Figure 9 is the fiber patch panel in the MDF. In this example, the cable is running to three (3) different IDF's. Each port is labeled with the room number – cable number.

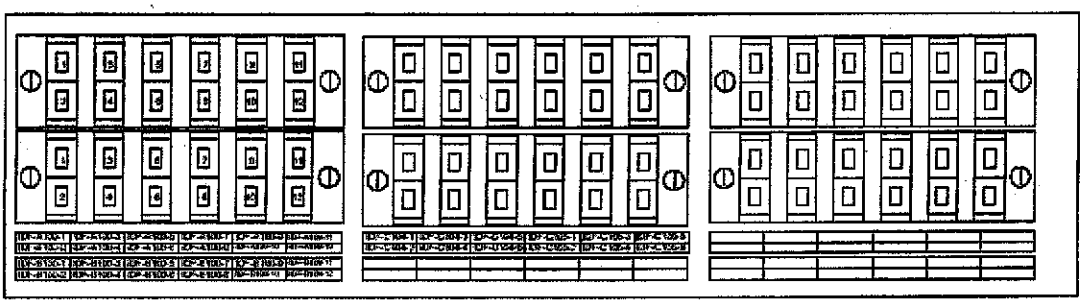


Fig. 9

4. LABELING SECONDARY NETWORK CLOSETS (IDF1, IDF2, ETC...)
   a. All IDF equipment racks will have a visible label using the following convention "IDF-room number" As shown on Figure 3.
   b. IDF rack and patch panels will be populated in accordance with MDF labeling in Figures 8 and 9.
5. LABELING LAB, MEDIA ROOM AND TRADE AND INDUSTRIAL AREA IDF'S
   a. The racks in these closets will have a visible label using the following convention: "IDF-Room Number" and placed as shown on Figure 5.
   b. The following Figure 10 explains how copper patch panels will be labeled for a lab. Note each port is labeled with "Room Number – Cable Number" which relates to the wall plate port in the classroom. For example C104-1 thru C104-30 are labeled below.

Fig. 10

c. Fiber patch panels are labeled similar to the copper patch panels. The label represents where the fiber is terminated on the other end of the cable.

d. The following Figure 11 is an example of a fiber patch panel in an IDF. In this example, the cable is terminated in the MDF.

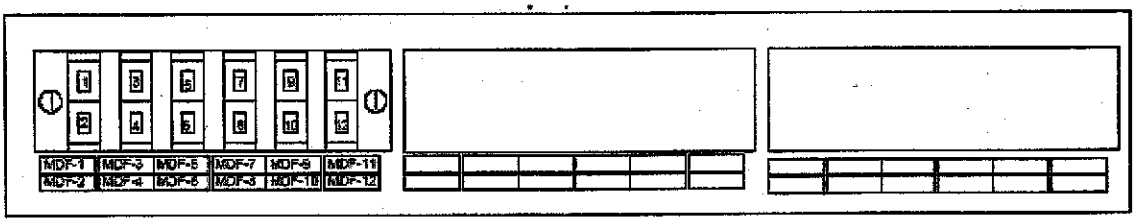


Fig. 11

6. LABELING FIBER AND CAT-6 CABLE
   a. Identify cables according to the labeling scheme per TIA/EIA 606 standards on the cable and each terminating location.
   b. The cable will be labeled with this format: room number – cable number - room number. For example cable 1 in room C104 terminating in the IDF that is in room D100, the cable will be labeled C104-1-D100. For cable 1 in room C104 terminating in the MDF-B rack, it will be labeled C104-1-MDF-B.

I. GROUNDING AND BONDING
   1. Provide a Telecommunications Bonding Backbone (TBB). This backbone will be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB will be installed independent of the buildings electrical and building ground.
   2. The main entrance facility/equipment room in each building will be equipped with a telecommunications main grounding bus bar (TMGB). Each technology support areas will be provided with a telecommunications ground bus bar (TGB). The TMGB will be connected to the building electrical entrance grounding facility.
   3. Ground all racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MDF or IDF to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors.
      a. All wires used for telecommunications grounding purposes will be identified with green insulation. Non-insulated wires will be identified at each termination point with a wrap of green tape. All cables and bus bars will be identified and labeled consistent with the labeling system.
      b. The TBB will be designed and/or approved by a qualified PE licensed in Oklahoma. The TBB will adhere to the recommendations of the TIA/EIA-607 Telecommunications Bonding and Grounding Standard, and will be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, will be performed by a licensed electrical contractor.

J. WARRANTY
   1. The Contractor shall provide a system warranty covering the installed cable system against defects in workmanship, components, and performance, and follow-on support after project completion.
   2. The Contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the I-89 School District.
   3. CABLING SYSTEM WARRANTY: The contractor shall facilitate at least a ten (10) year performance warranty between the manufacturer and the I- 89 School District. An extended component warranty shall be provided which warrants functionality of all components used in the system for at least 10 years from the date of acceptance. Copper links shall be warranted against the link performance minimum expected results defined in the TIA/EIA 568B, TSB-67. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in the TIA/EIA 568B, Annex H.

K. TESTING AND VALIDATION
   1. GENERAL

a. Testing and validation is to verify cabling system and performance and to ensure accuracy. Test all cables in accordance with this document, the ANSI/TIA/EIA standards and best industry practices. If any are in conflict, the Contractor will be responsible to bring any discrepancies to the attention of the Architect for clarification and/or resolution.

b. A third party contractor will do random testing. More than one (1) Failure to the threshold requirements could result, at I-89 School District's discretion, a third party corrective action and retesting of all cables at the installation vendors expense.

c. The OCMAPS Program Manager will have approval on all submittal processes.

d. Provide equipment for evaluation/validation and testing, including a copy of all service manuals.

e. A schedule of all validation tests will be developed as required regarding on-site assembly, installation, hardware, software and network testing.

f. Print scanner tests on 8-1/2" x 11".

g. Upon completion of the installation, the contractor will provide three (3) full documentation sets [Two (2) books and one (1) electronic delivered to the OCMAPS Program Manager] containing all reference and validation information, including:

h. Documentation showing individual listing of each cable pulled in the facility, with detail including:

1) Type of cabling.
   a) Source location.
   b) Destination location.
   c) Wire number label consistent with specified label system.
   d) Validation sign off
   e) Comment area - leave blank if not used.
   f) All cabling copper and fiber must be validated through Level III Tester or OTDR.
   g) The Contractor will provide a copy of the contractors' Quality Assurance Document

2. Copper

a. Test each cable for continuity on all pairs and/or conductors. Twisted-pair voice backbone cables will be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Horizontal UTP cables for data, voice or video will be tested for the all of the above requirements, plus tests that indicate installed cable performance. The test conducted will meet or exceed the requirements for an installed link of the respective category rating as defined by the 568-B Standard and associated documents.

b. Test each cable for continuity on all pairs and/or conductors. Twisted-pair voice backbone cables will be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Horizontal UTP cables for data, voice or video will be tested for the all of the above requirements, plus tests that indicate installed cable performance. The test conducted will meet or exceed the requirements for an installed link of the respective category rating as defined by the 568-B Standard and associated documents.

c. Performance Verification: Performance verify high speed UTP horizontal distribution cable using an automated test set. This test set will be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
   1) Near End Cross-Talk (NEXT)
   2) Attenuation
   3) Power Sum Attenuation to Cross-Talk Ratio (PSACR)

d. Test results will be automatically evaluated by the equipment, using the most up to date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results will be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results will include all tests performed, the expected test result, the actual test result achieved, and a pass/fail indication for each installed link under test.

3. Fiber Optic:

a. All fiber terminations will be visually inspected with a minimum 100 X microscope to ensure that no surface imperfections exist after final

polishing. Fiber strands will be tested for attenuation with an optical power meter and light source.

b. Link loss specifications: Each fiber link less than or equal to 2km will be tested according to ANSI's Fiber Optic Test Procedures (FOTP) 171 and must be less than or equal to 3.5.dB. An Optical Time Domain Reflectometer (OTDR) trace must be done on links greater than 2km. All fiber strands will be tested with Light Source and Optical meter for maximum dB loss.

c. Attenuation:

1) Horizontal distribution multimode optical fiber attenuation will be measured in one direction at either 850 nanometers (nm) or 1300 nm using an LED light source and power meter. Backbone multimode fiber will be tested at both 850 n and 1300 nm in one direction. Test set-up and performance will be conducted in accordance with ANSI/TIA/EIA-526-14 standard, Method B. One (1) 2-meter patch cord will be used for the test reference and two (2) 2-meter patch cords will be used for the actual test. This test method used a one (1) jumper reference, two (2) jumper test to estimate the actual link loss of the installed cables plus the loss of two (2) connectors. This measurement is consistent with the loss which network equipment will be under normal installation and use. Test evaluation for the panel to panel (backbone) or panel to outlet (horizontal) will be based on the values set forth in the TIA/EIA-568-B Annex H, Optical Fiber Link Performance Testing.

2) Single-mode optical fiber attenuation will be measured at 1310 nm and 1500 nm using a laser light source and power meter. Tests will be performed at both wavelengths in one direction on each strand of fiber. The set-up and test will be performed in accordance with TIA/EIA-526-7 standard, Method 1A. Two (2) meter patch cords will be used as test references and for the actual test. This test method utilizes a one (1) jumper reference, two (2) jumper test to estimate the actual link loss of the install cable plus two (2) patch cords.

3) Test evaluation for the panel to panel (backbone) will be based on the values set forth in the TIA/EIA-568-B annex H, Optical fiber link performance testing.

4) Attenuation testing will be performed with a stable launch condition using two (2) meter jumpers to attach the test equipment to the cable plant. The light source will be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables will be evaluated based on the following formula: Manufacturer's maximum attenuation per kilometer, divided by 1000 and then multiplied by the installed cable length in meters. For this application, the length based on cable length measurements marked on the jacket, will be suitable. If OTDR testing is performed in accordance with statements above, then the actual measured length will be used. Conversion from metric to US standard measurement will use 3.2808 as a constant with the result rounded to the next highest whole number. The adjusted cable attenuation value will be added to the manufacturer's mean loss per mated pair of connectors multiplied by the number of mated pairs under test. The testing for this project is measuring the loss over the installed cable plus two (2) jumpers which account for three (3) mated pairs of connectors. Subtract one (1) mated pair for the equipment interface to arrive at a total of two (2) mated pairs under test.

5) The expected results for each cable (or group of cables of the same nominal length) will be calculated before the start of testing and recorded in a space provided on the Contractor's test matrix. Each strand of fiber in the respective cable will be evaluated against this target number. Any fibers that exceed this value by more than (.5 dB) will be repaired or replaced at no cost to the I-89 School District.

L. SUBMITTALS
1. Provide specification data sheets on each individual system component.
2. As-Built Drawings
a. Specify the Contractor shall be responsible for creating red-line as-built drawings during the construction showing all deviations from plans and to submit these as-built drawings to the Architect after Substantial Completion.
3. Specify the Contractor shall provide test results of the installed components.

PART 2 PRODUCTS

1.01 Refer to the previous Design Sections for product information.

PART 3 EXECUTION

1.01 INSTALLATION

A. General
1. Provide all equipment, cable, connectors, conduit, outlet boxes and all other devices required for the erection of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, the contract drawings and specifications. Color code shall be used throughout.
2. Where slack cable is prescribed, it shall be neatly coiled, bound and stored in the ceiling and independently supported.
3. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
4. Cables shall be installed in continuous lengths from origin to destination with no splices unless specifically addressed in this document.
5. Where cable splices are allowed, they shall be in accessible locations and housed in an enclosure intended and suitable for the purpose.
6. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Bend radius in the termination area shall not be less than 4 times the outside diameter of the cable.
7. All cables shall either be in conduit or cable tray, or J-hooks or trapeze system for entire length. J-hook systems shall be supported at a minimum of 4' intervals. Refer to drawings for conduit size and cable tray locations. Minimum conduit size shall be ¾".
8. Bundle horizontal distribution cables in groups not greater than 40 cables.
9. Install cable above fire-sprinkler systems and do not attach to the system or any ancillary equipment or hardware.
10. Install the cable system and support hardware so it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
11. Cables shall not be attached to ceiling grid or lighting support wires. Where lightweight support for drop cable legs are required, the Contractor shall install clips to support the cabling.
12. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the I-89 School District.
13. Identify cables by a self-adhesive label in accordance with the System Documentation Section of this specification. Apply the cable label to the cable behind the faceplate on a section of cable that can be accessed by removing the outlet plate.
14. Backbone cables shall be installed separately from horizontal distribution cables.
15. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits or in separate inner ducts within conduits.
16. Where backbone cables and distribution cables are installed in a cable tray or wire way, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
17. Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
18. The cable jacket shall be maintained as close as possible to the termination point.

B. Horizontal Unshielded Twisted Pair Cabling
1. Pair cables shall be coiled in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius. In

the hollow wall installations where box eliminators are used, excess wire can be stored in the wall. No more than 12" of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be coiled and stored in the ceiling above each drop location where insufficient space exists in the outlet box.

2. Pair untwist of UTP cable at the termination area shall not exceed ½".
3. Install the unshielded twisted pair cable so there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run and at the termination field.
4. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.

C. Horizontal Fiber Optic Cabling

1. Fiber feed-through inserts shall exit the faceplate parallel to the mounting surface and the bottom of the faceplate in a vertical orientation.
2. Store a minimum of 36" of slack at the drop end and 72" at the termination enclosure.

1.02 FIRESTOPPING

A. Provide UL Classified to ASTM E814 (UL 1479) firestopping system rated to match respective wall or floor where cable and/or conduit pass through a firerated wall or floor. Fire stopping shall be approved by a qualified Professional Engineer (PE) licensed in the state where the work is to be performed. A drawing showing the proposed fire stopped system, stamped/embossed by the cognizant PE shall be provided to the I-89 School District's Technical Representative prior to installing the fire stop system(s).

B. All fire stop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cabling system acceptance.

1.03 SYSTEM DOCUMENTATION

A. General:

1. The following section describes the labeling, as-built documentation, and test documentation required to be produced and/or maintained by the Contractor during the course of the installation.

B. Labeling:

1. The Contractor shall develop and submit for approval a labeling system for the cable installation. The I-89 School District will negotiate an appropriate labeling scheme with the successful Contractor. The Contractor, using the drawings as a reference, shall clearly identify all components of the system: racks, cables, panels and outlets. The labeling system for horizontal cable shall designate the cables origin and destination. Backbone cables, coax and voice, shall designate the cables origin and destination. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure. All test documents shall reflect the appropriate labeling scheme. All labeling information shall be recorded on the as-built drawings.
2. All label printing will be machine generated using indelible ink ribbons or cartridges. Self-laminating labels will be used on cable jackets, appropriately sized to the outside diameter of the cable, and placed within view at the termination point on each end. Outlet labels will be the manufacturer's label provided with the outlet assembly, on the faceplate.

C. As-Built Drawings:

1. The installation contractor will be provided with one set of drawings at the start of the project. This set will be designated used to document all as-built information as it occurs throughout the project. The set will be maintained by the Contractor on a daily basis, and will be available to the OCMAPS Program Manager and the Program Consultant upon request during the course of the project. Anticipated variations from the build to drawings will be allowed for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, grounding conductors and hardware unless approved in writing by the I-89 School District.
2. The Contractor shall provide the as-built drawing set to the I-89 School District at the conclusion of the project. The marked up drawing set will accurately depict the as-built

status of the system including termination locations, cable routing, and all administration labeling for the cable system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system. The Contractor shall provide at least two (2) sets of drawings in color hard copy and AutoCAD file.

D. TEST DOCUMENTATION

1. Provide test documentation in a three- (3-) ring binder(s) within three (3) weeks of the completion of installation. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). The binder shall be divided by major heading tabs. Each major heading shall be further sectioned by test type. Test data within each section shall be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.
2. Print scanner tests on 8-1/2" x 11". Document hand written test results (attenuation results and continuity results) on a test form provided by the Contractor.
3. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

END OF SECTION

Section 17750-1
Room Data Schedule

PART 1 GENERAL

1.01 SUBMITTAL OF THE ROOM DATA SCHEDULE

A. This submittal shall consist of a completed Room Data Schedule as provided in this section. Refer to Division One for equipment submittal procedures.

B. The Room Data Schedule shall be submitted by the Contractor for approval by the General Contractor, Architect, OCMAPS, and The Facility Group. Submit as a shop drawing.

END OF SECTION

Section 17760
Intercom Systems

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of contract, including general and supplementary conditions and Division - 1 specification section, apply to work of this section.

1.02 DESCRIPTION OF WORK

A. The contractor shall furnish a complete intercom system in the addition to match and extend from central systems and similar components of the existing building. The complete installation shall meet the requirements of the National Electric, and other prevailing codes. The system shall include the devices as shown on the plans, and any other control panels, power supplies, initiating devices and accessories required to provide a complete operating intercom systems, both in the existing and new building addition.

B. All equipment shall be labeled with the same manufacturers name to assure the integration of the complete system. "Mix and Match" systems are not approved.

C. The system supplier and installer shall be a factory authorized distributor and shall stock sufficient spare parts to properly maintain the system.

1.03 SYSTEM OPERATION

A. Submit shop drawings of the entire system and proposed zoning with sequence of operation.

PART 2 - MATERIALS

2.01 MATERIALS

A. Refer to Electrical plans.

----------END OF SECTION----------

SECTION 17975

Building Automation System

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Building Automation System (BAS) manufacturer shall furnish and install a fully integrated building automation system, incorporating direct digital control (DDC) for energy management, equipment monitoring and control, and subsystems with open communications capabilities as herein specified. The DDC panel(s) shall be Siemens, to network with the existing Siemens monitoring system. The interface must, in "every particular", provide transparent operation down to and including full programming capability from the existing Siemens system. Refer to OCMAPS Clarifications, Attachments "T" and "T1". Provisions of this section shall meet all requirements therein. Communication to existing Siemens Building Technologies BAS may be done via P1/BACNet. Please contact Matt Kwiatkowski at (405) 625-9728 with questions or for additional information.

B. The DDC contractor shall include all programming and graphics creation necessary to provide a complete and functional system. Programming shall include Siemens Management Level Network workstation and client programming, field panel programming, and field device programming. Siemens workstation and client programming shall be performed by factory trained and authorized technicians utilizing the most recent versions of Siemens programming tools and software sets.

C. The DDC control system shall communicate with the existing Siemens energy management system via the districts existing Ethernet network. Duplicate and distinct communications trunks or systems are not acceptable.

D. The installation of the control system shall be performed under the direct supervision of the controls manufacturer with the shop drawings, flow diagrams, bill of materials, component designation or identification number and sequence of operation all bearing the name of the manufacturer. The installing manufacturer shall certify in writing, that the shop drawings have been prepared by the equipment manufacturer and that the equipment manufacturer has supervised their installation. In addition, the equipment manufacturer shall certify, in writing, that the shop drawings were prepared by their company and that all temperature control equipment was installed under their direct supervision.

E. All materials and equipment used shall be standard components, regularly manufactured for this and/or other systems and not custom designed specially for this project. All systems and components shall have been thoroughly tested and proven in actual use for at least two years.

F. BAS manufacturer shall be responsible for all BAS and Temperature Control wiring for a complete and operable system. All wiring shall be done in accordance with all local and national codes.

1.2 WORK BY OTHERS

A. Mechanical contractor installs all wells, valves, taps, dampers, flow stations, etc. furnished by BAS manufacturer if required.

B. Electrical Contractor provides:
1. 120V power to all BAS an/or Temperature control panels
2. Wiring of all power feeds through all disconnect starters to electrical motor.
3.

Wiring of any remote start/stop switches and manual or automatic motor speed control devices not furnished by BAS manufacturer

4. Wiring of any electrical sub-metering devices furnished by BAS manufacturer or others.
5. Ethernet drops and IP addresses provided and installed as/where required by BAS contractor. (IP addresses by OCPS IT Group)
6. Contactors for lighting control (if required) within 10 ft. of BAS panel.

1.3 RELATED WORK

A. Division 01000 General and Special Conditions
B. Division 15000 Mechanical
C. Division 16000 Electrical

1.4 QUALITY ASSURANCE

A. The BAS system shall be designed and installed, commissioned and serviced by manufacturer employed, factory trained personnel. Manufacturer shall have an in-place support facility within 100 miles of the site with technical staff, spare parts inventory and necessary test and diagnostic equipment. Distributors or licensed installing contractors are not acceptable.

The Bidder shall be regularly engaged in the manufacturing, installation and maintenance of BMS systems and shall have a minimum of ten (10) years of demonstrated technical expertise and experience in the manufacture, installation and maintenance of B.M.S. systems similar in size and complexity to this project. A maintained service organization consisting of at least ten (10) competent servicemen for a period of not less than ten years and provide a list of 10 projects, similar in size and scope to this project, completed within the last five years.

B. Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.

C. All BAS peer-to-peer network controllers, central system controllers and local user displays shall be UL Listed under Standard UL 916, category PAZX; Standard ULC C100, category UUKL7; and under Standard UL 864, categories UUKL, UDTZ, and QVAX. and be so listed at the time of bid. All floor level controllers shall comply, at a minimum, with UL Standard UL 91 6category PAZX; Standard UL 864, categories UDTZ, and QVAX, and be so listed at the time of Bid.

D. The BAS peer-to-peer network controllers and local user display shall also comply with the Australian Electromagnetic Compatibility (EMC) Framework, and bear the C-Tic Mark to show compliance. The purpose of the regulation is to minimize electromagnetic interference between electronic products, which may diminish the performance of electrical products or disrupt essential communications.

E. DDC peer-to-peer controllers shall be compliant with the European EMC Directive, Standards EN 50081-2 and EN 50082-2, at the Industrial Levels. Additionally the equipment shall be compliant with the European LVD Directive and bear the CE mark in order to show compliance to both Directives."

F. All electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference and be so labeled.

G. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing) and ISO-140001 (The application of well-accepted business management principles to the environment). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.

H. This system shall have a documented history of compatibility by design for a minimum of 15 years. Future compatibility shall be supported for no less than 10 years. Compatibility shall be

defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.

Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

I. The building automation system (BAS) shall conform to the following standard for Year 2000 Compliance:

1. The system shall not produce errors when processing date data (including calculating, sorting or displaying) from, into and between the years 1999 and 2000 and leap year calculations in the year 2000, to the extent that date information provided from other systems, is accurate.
2. The BAS supplier shall provide documentation to support the individual device(s) Year 2000 Compliance. This document shall include a listing of compliance by device and any exceptions to the above definition.

1. 5 SUBMITTALS

A. Submit 10 complete sets of documentation in the following phased delivery schedule:

1. Valve and damper schedules
2. Equipment data cut sheets
3. System schematics, including:
   - sequence of operations
   - point names
   - point addresses
   - interface wiring diagrams
   - panel layouts.
   - system riser diagrams
4. Auto-CAD compatible as-built drawings

B. Upon project completion, submit operation and maintenance manuals, consisting of the following:

Index sheet, listing contents in alphabetical order
Manufacturer's equipment parts list of all functional components of the system, Auto-CAD disk of system schematics, including wiring diagrams
Description of sequence of operations
As-Built interconnection wiring diagrams
Operator's Manual
Trunk cable schematic showing remote electronic panel locations, and all trunk data
List of connected data points, including panels to which they are connected and input device (ionization detector, sensors, etc.)

1.6 WARRANTY

A. Provide all services, materials and equipment necessary for the successful operation of the entire BAS system for a period of one year after beneficial use.

B. The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.

C. The on-line support services shall allow the local BAS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 8 hours of the time that the problem is reported, normal business hours.

If the problem cannot be resolved on-line by the local office, the national office of the building automation system manufacturer shall have the same capabilities for remote connection to the facility. If the problem cannot be resolved with on-line support services, the BAS manufacturer

shall dispatch the appropriate personnel to the job site to resolve the problem within 4 hours of the time that the problem is reported.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Siemens Building Technologies, Inc.

2.2 NETWORKING COMMUNICATIONS

A. The design of the BAS shall network operator workstations and DDC Controllers. The network architecture consists of multiple levels for communication efficiency, a campus-wide (Management Level) Ethernet network based on TCP/IP protocol, high performance peer-to-peer building level network(s) and DDC Controller floor level local area networks with access being totally transparent to the user when accessing data or developing control programs.

B. The design of BAS shall allow the co-existence of new DDC Controllers in the existing Siemens MLN without the use of gateways or protocol converters.

1. System shall have the capability to communicate with a network over Ethernet or BACnet/IP. Minimum system functionality must include monitoring, commanding, and alarming for daily operator functions from the existing workstation.

2. Refer to chart located on page 7, section 2.4.1 for appropriate equipment interface requirements.

3. System shall have the capability to be an OPC Client and Server for dynamic communication with OPC Clients or Servers over an Ethernet network. At a minimum, the following must be supported:

a. Data Access 1.0 (96), 1.0A (97) and 2.0 (11/98)

b. Alarms & Events 1.0 (1/99)

4. If the existing DDC controllers do not have the specified capabilities, the controller must be upgraded to meet the specifications in Part II. BAS manufacturer shall be responsible for hardware, software & labor to update the existing DDC controller to meet the specifications.

C. Peer-to-Peer Building Level Network:

1. All operator devices that reside on the shall have the ability to access all point status and application report data or execute control functions for any and all other devices via the peer-to-peer network. No hardware or software limits shall be imposed on the number of devices with global access to the network data at any time.

2. The peer-to-peer network shall support a minimum of 100 DDC controllers and PC workstations

3. Each PC workstation shall support a minimum of 4 peer-to-peer networks hardwired.

4. The system shall support integration of third party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for interprocess control. All exchange points shall have full system functionality as specified herein for hardwired points.

5. Field panels must be capable of integration with open standards including Modbus, BACnet, and Lonworks as well as with third party devices via existing vendor protocols.

6. The peer-to-peer Building Level Network shall be capable of using the TCP/IP over Ethernet. All devices must:

   a. Auto-sense 10/100 Mbps networks

   b. Receive an IP Address from a Dynamic Host Configuration Protocol (DHCP) Server or be configured with a Fixed IP Address.

   c. Resolve Name to IP Addresses for devices using a Domain Name Service (DNS) Server on the Ethernet network.

   d. All access using Telnet.

D. Existing Management Level Network (MLN)

a. All Ethernet-capable PCs will simultaneously direct connect to the Ethernet Management Level Network without the use of an interposing device.

b. Operator Workstation is capable of simultaneous direct connection and communication with BACnet, OPC, and Apogee MLN networks without the use of interposing devices.

c. The Management Level Network does not impose a maximum constraint on the number of operator workstations.

d. A controller residing on the peer-to-peer building level networks shall connect to Ethernet network without the use of a PC or a gateway with a hard drive.

e. Any PC on the Ethernet Management Level Network shall have transparent communication with controllers on the building level networks connected via Ethernet, as well as, directly connected building level networks. Any PC shall be able to interrogate any controller on the building level network.

f. Any break in Ethernet communication from the PC to the controllers on the building level networks shall result in an alarm notification at the PC.

g. The standard client and server workstations on the Management Level Network shall reside on industry standard Ethernet utilizing standard TCP/IP, IEEE 802.3

h. Any break in Ethernet communication between the standard client and server workstations on the Management Level Network shall result in a notification within the Windows taskbar at each workstation.

i. Access to the system database shall be available from any standard client workstation on the Management Level Network.

j. Client access to client-server workstation configurations over low-bandwidth network technologies shall be available optionally via Windows Terminal Services or Web browser interface. Remote client access via Windows Terminal Services shall provide multiple, independent sessions of the workstations software – Terminal Services clients shall have workstation software access, without the need to install the workstation software on the local hard drive.

2.3 DDC CONTROLLER FLOOR LEVEL NETWORK:

A. This level communication shall support a family of application specific controllers and shall communicate with the peer-to-peer network through DDC Controllers for transmission of global data.

B. This network may utilize the EIA standard 709.1, LonTalk protocol for peer-to-peer communication and integration of 3rd party Lon Mark devices.

2.4 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLERS

A. The DDC & HVAC Mechanical Equipment Controllers shall reside on the Building Level Network.

B. DDC & HVAC Mechanical Equipment Controllers shall use the same programming language and tools. DDC & HVAC Mechanical Equipment Controllers which require different programming language or tools on a network are not acceptable.

C. DDC & HVAC Mechanical Equipment Controllers which do not meet the functions specified in Section 2.4.2 and Section 2.5 for DDC Controllers or Section 2.4.3 and Section 2.5 for HVAC Mechanical Equipment Controllers are not acceptable.

2.4.2 DDC CONTROLLER

A. DDC Controllers shall be a 16-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors, communication controllers, power supplies and input/output point modules. Controller size shall be sufficient to fully meet the requirements of this specification and the attached point I/O schedule. Each controller shall support a minimum of three (3) Floor Level Application Specific Controller Device Networks.

B. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Dial-up communications
9. Manual override monitoring

C. Each DDC Controller shall support firmware upgrades without the need to replace hardware.

D. Provide all processors, power supplies and communication controllers so that the implementation of a point only requires the addition of the appropriate point input/output termination module and wiring.

E. DDC Controllers shall provide a RS-232C serial data communication ports for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals. DDC Controllers shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems, printers or terminals.

F. As indicated in the point I/O schedule, the operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.

1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.

2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.

G. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.

H. Each DDC Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all panel components. The DDC Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

I. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

1. RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V

2. Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact

3. Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power

4. Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max)

5. Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

a. IEEE Standard 587-1980

b. UL 864 Supply Line Transients

c. Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

J. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 60 days.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

K. Provide a separate DDC Controller for each AHU or other HVAC system as indicated in Section 3.02. It is intended that each unique system be provided with its own point resident DDC Controller.

2.4.3 HVAC MECHANICAL EQUIPMENT CONTROLLERS

A. HVAC Mechanical Equipment Controllers shall be a 12-bit stand-alone, multi-tasking, multi-user, real-time digital control processors consisting of modular hardware with plug-in enclosed processors.

B. Each HVAC Mechanical Controller shall have sufficient memory to support its own operating system and databases, including:

1. Control processes
2. Energy management applications
3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
4. Historical/trend data for points specified
5. Maintenance support applications
6. Custom processes
7. Operator I/O
8. Remote communications

C. HVAC Mechanical Equipment Controllers shall provide a RS-232C serial data communication port for operation of operator I/O devices such as industry standard printers, operator terminals, modems and portable laptop operator's terminals.

D. HVAC Mechanical Equipment Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device.

E. Each HVAC Mechanical Equipment Controller shall continuously perform self-diagnostics, communication diagnosis and diagnosis of all components. The HVAC Mechanical Equipment Controller shall provide both local and remote annunciation of any detected component failures, low battery conditions or repeated failure to establish communication.

F. Isolation shall be provided at all peer-to-peer network terminations, as well as all field point terminations to suppress induced voltage transients consistent with:

- RF-Conducted Immunity (RFCI) per ENV 50141 (IEC 1000-4-6) at 3 V
- Electro Static Discharge (ESD) Immunity per EN 61000-4-2 (IEC 1000-4-2) at 8 kV air discharge, 4 kV contact
- Electrical Fast Transient (EFT) per EN 61000-4-4 (IEC 1000-4-4) at 500 V signal, 1 kV power
- Output Circuit Transients per UL 864 (2,400V, 10A, 1.2 Joule max) Isolation shall be provided at all peer-to-peer panel's AC input terminals to suppress induced voltage transients consistent with:

  IEEE Standard 587-1980
  UL 864 Supply Line Transients
  Voltage Sags, Surge, and Dropout per EN 61000-4-11 (EN 1000-4-11)

G. In the event of the loss of normal power, there shall be an orderly shutdown of all HVAC Mechanical Equipment Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the HVAC Mechanical Equipment Controller shall automatically resume full operation without manual intervention.

2. Should HVAC Mechanical Equipment Controller memory be lost for any reason, the user shall have the capability of reloading the HVAC Mechanical Equipment Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.

2.5 DDC & HVAC MECHANICAL EQUIPMENT CONTROLLER RESIDENT SOFTWARE FEATURES

A. General:

1. The software programs specified in this Section shall be provided as an integral part of DDC and HVAC Mechanical Equipment Controllers and shall not be dependent upon any higher level computer for execution.

2. All points shall be identified by up to 30 character point name and 16 character point descriptor. The same names shall be used at the PC workstation.

3. All digital points shall have user defined two-state status indication (descriptors with minimum of 8 characters allowed per state (i.e. summer/winter)).

B. Control Software Description:

1. The DDC and HVAC Mechanical Equipment Controllers shall have the ability to perform the following pre-tested control algorithms:

a. Two-position control

b. Proportional control

c. Proportional plus integral control

d. Proportional, integral, plus derivative control

e. Automatic tuning of control loops

f. Model-Free Adaptive Control

C. DDC and HVAC Mechanical Equipment Controllers shall provide the following energy management routines for the purpose of optimizing energy consumption while maintaining occupant comfort.

1. Start-Stop Time Optimization (SSTO) shall automatically be coordinated with event scheduling. The SSTO program shall start HVAC equipment at the latest possible time that will allow the equipment to achieve the desired zone condition by time of occupancy. The SSTO program shall also shut down HVAC equipment at the earliest possible time before the end of the occupancy period, and still maintain desired comfort conditions.

   a) The SSTO program shall operate in both the heating and cooling seasons.

      1) It shall be possible to apply the SSTO program to individual fan systems.
      2) The SSTO program shall operate on both outside weather conditions as well as inside zone conditions and empirical factors.

   b) The SSTO program shall meet the local code requirements for minimum outside air while the building is occupied.

2. Event Scheduling: Provide a comprehensive menu driven program to automatically start and stop designated points or groups of points according to a stored time.

   a) It shall be possible to individually command a point or group of points.

   b) For points assigned to one common load group, it shall be possible to assign variable time delays between each successive start or stop within that group.

   c) The operator shall be able to define the following information:

      1 Time, day
      2. Commands such as on, off, auto, and so forth.
      3. Time delays between successive commands.
      4. There shall be provisions for manual overriding of each schedule by an appropriate operator.

   d) It shall be possible to schedule events up to one year in advance.
      1. Scheduling shall be calendar based.
      2. Holidays shall allow for different schedules.

3. Enthalpy switchover (economizer) .The Energy Management Control Software (EMCS) will control the position of the air handler relief, return, and outside air dampers. If the outside air dry bulb temperature falls below changeover set point the EMCS will modulate the dampers to provide 100 percent outside air. The user will be able to quickly changeover to an economizer system based on dry bulb temperature

and will be able to override the economizer cycle and return to minimum outside air operation at any time.

4. Temperature-compensated duty cycling.

   a) The DCCP (Duty Cycle Control Program) shall periodically stop and start loads according to various patterns.

   b) The loads shall be cycled such that there is a net reduction in both the electrical demands and the energy consumed.

5. Automatic Daylight Savings Time Switchover: The system shall provide automatic time adjustment for switching to/from Daylight Savings Time.

6. Night setback control: The system shall provide the ability to automatically adjust setpoints for night control.

7. Loop Control. A Model Free Adaptive Control algorithm or alternately a PID (proportional-integral-derivative) closed-loop with direct or reverse action and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, set point, and weighting parameters shall be user-selectable.

D. DDC and HVAC Mechanical Equipment Controllers shall be able to execute custom, job-specific processes defined by the user, to automatically perform calculations and special control routines.

1. A single process shall be able to incorporate measured or calculated data from any and all other DDC and HVAC Mechanical Equipment Controllers on the network. In addition, a single process shall be able to issue commands to points in any and all other DDC and HVAC Mechanical Equipment Controllers on the network. Database shall support 30 character, English language point names, structured for searching and logs.

2. Processes shall be able to generate operator messages and advisories to operator I/O devices. A process shall be able to directly send a message to a specified device or cause the execution of a dial-up connection to a remote device such as a printer or pager.

3. DDC and HVAC Mechanical Equipment Controller shall provide a HELP function key, providing enhanced context sensitive on-line help with task orientated information from the user manual.

4. DDC and HVAC Mechanical Equipment Controller shall be capable of comment lines for sequence of operation explanation.

E. Alarm management shall be provided to monitor and direct alarm information to operator devices. Each DDC and HVAC Mechanical Equipment Controller shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic and prevent alarms from being lost. At no time shall the DDC and HVAC Mechanical Equipment Controllers ability to report alarms be affected by either operator or activity at a PC workstation, local I/O device or communications with other panels on the network.

1. All alarm or point change reports shall include the point's English language description and the time and date of occurrence.

2. The user shall be able to define the specific system reaction for each point. Alarms shall be prioritized to minimize nuisance reporting and to speed operator response to critical alarms. A minimum of six priority levels shall be provided for each point. Point

priority levels shall be combined with user definable destination categories (PC, printer, DDC Controller, etc.) to provide full flexibility in defining the handling of system alarms. Each DDC and HVAC Mechanical Equipment Controller shall automatically inhibit the reporting of selected alarms during system shutdown and start-up. Users shall have the ability to manually inhibit alarm reporting for each point.

3. Alarm reports and messages will be directed to a user-defined list of operator devices or PCs based on time (after hours destinations) or based on priority.

4. In addition to the point's descriptor and the time and date, the user shall be able to print, display or store a 200 character alarm message to more fully describe the alarm condition or direct operator response.

5. In dial-up applications, operator-selected alarms shall initiate a call to a remote operator device.

F. A variety of historical data collection utilities shall be provided to manually or automatically sample, store and display system data for points as specified in the I/O summary.

1. Any point, physical or calculated may be designated for trending. Any point, regardless of physical location in the network, may be collected and stored in each DDC and HVAC Mechanical Equipment Controllers point group. Two methods of collection shall be allowed: either by a pre-defined time interval or upon a pre-defined change of value. Sample intervals of I minute to 7 days shall be provided. Each DDC and HVAC Mechanical Equipment Controller shall have a dedicated RAM-based buffer for trend data and shall be capable of storing a minimum of __ data samples. All trend data shall be available for transfer to a Workstation without manual intervention.

2. DDC and HVAC Mechanical Equipment Controllers shall also provide high resolution sampling capability for verification of control loop performance. Documented evidence of tuned loop control shall be provided on a regular basis. (month, season, quarter, annual)

a. For Model-Free Adaptive control loops, evidence of tuned loop control shall be provided via graphical plots of trended data logs. Graphical plots shall minimally include depictions of setpoint, process variable (output), and control variable (e.g., temperature). Other parameters that may influence loop control shall also be included in the plot (e.g., fan on/off, mixed air temp).

b. For PID control loops, operator-initiated automatic and manual loop tuning algorithms shall be provided for all operator-selected PID control loops. Evidence of tuned loop performance shall be provided via graphical plots or trended data logs for all loops.

1. In automatic mode, the controller shall perform a step response test with a minimum one-second resolution, evaluate the trend data, calculate the new PID gains and input these values into the selected LOOP statement.

2. Loop tuning shall be capable of being initiated either locally at the DDC and HVAC Mechanical Equipment Controller, from a network workstation or remotely using dial-in modems. For all loop-tuning functions, access shall be limited to authorized personnel through password protection.

G. DDC and HVAC Mechanical Equipment Controllers shall be capable of automatically accumulating and storing run-time hours for digital input and output points and automatically sample, calculate and store consumption totals for analog and digital pulse input type points, as specified in the point I/O schedule.

H. The peer-to-peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to access any data from or send control commands and alarm reports directly to any other DDC and HVAC Mechanical Equipment Controller or combination of controllers on the network

without dependence upon a central or intermediate processing device. DDC and HVAC Mechanical Equipment Controllers shall send alarm reports to multiple workstations without dependence upon a central or intermediate processing device. The peer to peer network shall also allow any DDC and HVAC Mechanical Equipment Controller to access, edit, modify, add, delete, back up, and restore all system point database and all programs.

I. The peer to peer network shall allow the DDC and HVAC Mechanical Equipment Controllers to assign a minimum of 50 passwords access and control priorities to each point individually. The logon password (at any PC workstation or portable operator terminal) shall enable the operator to monitor, adjust and control the points that the operator is authorized for. All other points shall not be displayed on the PC workstation or portable terminal (e.g. all base building and all tenant points shall be accessible to any base building operators, but only tenant points shall be accessible to tenant building operators). Passwords and priorities for every point shall be fully programmable and adjustable.

J. When part of a LonWorks network, the DDC or HVAC Mechanical Equipment Controller shall have a common database server for all LonWorks network information embedded. This embedded LonWorks network database server maintains a dynamic, real time representation of the LonWorks network including connections/bindings, node status, and configuration properties. A PC must NOT be required for this database.

2.6 FLOOR LEVEL NETWORK APPLICATION SPECIFIC CONTROLLERS (ASC)

A. Each DDC Controller shall be able to extend its performance and capacity through the use of remote application specific controllers (ASCs) through Floor Level LAN Device Networks.

B. Each ASC shall operate as a stand-alone controller capable of performing its specified control responsibilities independently of other controllers in the network. Each ASC shall be a microprocessor-based, multi-tasking, real-time digital control processor. Each ASC shall be capable of control of the terminal device independent of the manufacturer of the terminal device.

C. Terminal Equipment Controllers:

1. Provide for control of each piece of equipment, including, but not limited to, the following:

   a. Unit Heaters
   b. Humidifiers
   c. Rooftop Units
   d. Unit Conditioners
   e. Heat Pumps
   f. Unit Ventilators
   g. Room Pressurization

2. Controllers shall include all point inputs and outputs necessary to perform the specified control sequences. Analog outputs shall be industry standard signals such as 24V floating control, 3-15 psi pneumatic, 0-10v allowing for interface to a variety of modulating actuators.

3. All controller sequences and operation shall provide closed loop control of the intended application. Closing control loops over the FLN, BLN or MLN is not acceptable

2.7 FIELD DEVICES

A. Provide instrumentation as required for monitoring, control or optimization functions.

B. Room Temperature Sensors

1. Digital room sensors shall have LCD display, day / night override button, and setpoint slide adjustment override options. The setpoint slide adjustment can be software limited by the automation system to limit the amount of room adjustment.

Temperature monitoring range	+20/120°F -13° to 49°C)
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F (+/- 0.3°C)
Set Point and Display Range	55° to 95° F (13° to 35°C)

2. Duct (single point) temperature:

Temperature monitoring range	+20/120°F (-7°/49°C)
Output signal	Changing resistance
Accuracy at Calibration point	±0.5°F (+/-0.3°C)

3. Duct Average temperature:

Temperature monitoring range	+20° ±120°F(-7°/+49°C)
Output signal	4 – 20 mA DC
Accuracy at Calibration point	±0.5°F (±03°C)
Sensor Probe Length	25' L (7.3m)

4. Outside air temperature:

Temperature monitoring range	-58°±122° F(-50°C to +50°C)
Output signal	4 – 20 mA DC
Accuracy at Calibration point	±0.5°F (+/-0.3°C)

C. Differential pressure:

1. Unit for air flow shall be Siemens Building Technologies SW141.

Set point ranges: 0.5" WG to 1.0" WG (124.4 to 248.8 Pa)
1.0" WG to 12.0" WG (248.8 to 497.6 Pa)

D. Static pressure sensor:

Range	0 to .5" WG (0 to 124.4 Pa) 0 to 1" WG (0 to 248.8 Pa) 0 to 2" WG (0 to 497.7 Pa) 0 to 5" WG (0 to 1.2 kPa 0 to 10" WG (0 to 2.5 kPa)
Output Signal	4 – 20 mA VDC
Combined static error	0.5% full range
Operating Temperature	-40° to 175° F (-40C to 79.5°C)

E. Air Pressure Sensor:

Range:	0 to 0.1 in. water (0 to 24.9 Pa) 0 to 0.25 in. water (0 to 63.2 Pa) 0 to 0.5 in. water (0 to 124.5 Pa) 0 to 1.0 in. water (o to 249 Pa) 0 to 2.0 in water 90 to 498 Pa) 0 to 5.0 in. water (0 to 1.25 kPa) 0 to 10.0 in.water (0 to 2.49 kPa)
Output signal	4 to 20 mA
Accuracy	±1.0% of full scale

F. Humidity Sensors:

Range	0 to 100% RH
Sensing Element	Bulk Polymer
Output Signal	4 – 20 mA DC

Accuracy	At 77°F(25°C) ± 2% RH

I. Control Valves (all control valves shall have electric actuators).

1. Electric Control

Range ability	40:1
Flow Characteristics	Modified. Equal percentage
Control Action	Normal open or closed as selected
Medium	Steam, water, glycol
Body Type	Screwed ends 2" and smaller, flanged Valves 2½" and larger
Body Material	Bronze
Body Trim	Bronze
Stem	Stainless Steel
Actuator	0-10 VDC, 4-20 MA or 2 position 24 VAC/120VAC

2. All automatic temperature control valves in water lines shall be provided with characterized throttling plugs and shall be sized for minimum 25% of the system pressure drop or 5 psi, whichever is less.

   a) Positive positioning relays shall be provided on pneumatic control when required to provide sufficient power for sequencing.

   b) Two position valves shall be line size.

J. Damper Actuators

1. Electric control shall be Siemens Building Technologies OpenAir™ direct coupled actuators.

2. Damper actuators shall be Brushless DC Motor Technology with stall protection, bi-directional, fail safe spring return, all metal housing, manual override, independently adjustable dual auxiliary switch.

   a) The actuator assembly shall include the necessary hardware and proper mounting and connection to a standard ½" diameter shaft or damper blade.

3. Actuators shall be designed for mounting directly to the damper shaft without the need for connecting linkages.

4. All actuators having more than 100 lb-in torque output shall have a self-centering damper shaft clamp that guarantees concentric alignment of the actuator's output coupling with the damper shaft. The self-centering clamp shall have a pair of opposed "v" shaped toothed cradles; each having two rows of teeth to maximize holding strength. A single clamping bolt shall simultaneously drive both cradles into contact with the damper shaft.

5. All actuators having more than a 100 lb-in torque output shall accept a 1" diameter shaft directly, without the need for auxiliary adapters.

6. All actuators shall be designed and manufactured using ISO900registered procedures, and shall be Listed under Standards UL873 and CSA22.2 No. 24-93 I.

B. Duct Smoke Detectors:

1. Duct smoke detectors will be provided and installed by the Division 16 Contractor in supply and return air ducts installed in accordance with local codes.

2. BAS Contractor shall connect the DDC System to the auxiliary contacts provided on the Smoke Detector as required for system safeties and to provide alarms to the DDC system.

PART 3 - EXECUTION

3.1 PROJECT MANAGEMENT

Provide a designated project manager who will be responsible for the following:

Construct and maintain project schedule
On-site coordination with all applicable trades, subcontractors, and other integration vendors
Authorized to accept and execute orders or instructions from owner/architect
Attend project meetings as necessary to avoid conflicts and delays
Make necessary field decisions relating to this scope of work

3.2 SEQUENCE OF OPERATION

A. **FCU Sequence of Operation**

1. An application specific DDC controller using electric actuation controls the fan coil unit (FCU). The controls will operate on heating or cooling cycles based on control system interlock to indicate whether heating or cooling is available. The space served by the FCU is controlled in Occupied and Unoccupied modes as follows:

2. **Occupied**
The FCU fan operates continuously. The controller monitors the room temperature sensor and modulates the FCU heating/cooling valve to maintain the space temperature at set point.

3. **Unoccupied**
The FCU is controlled using the Unoccupied space temperature set point. The FCU fan is off when the space is satisfied. The controller may reset to the Occupied mode for a predetermined time period upon a signal from the control system or manually from a switch at the room sensor.

4. The DDC system uses a current switch to monitor the FCU fan status.

B. **ERV Sequence of Operation**

1. The building automation system shall enable or give the ERV a start command when the building is occupied. On board controls control the ERV system. See Spec Section 15732.

2. Monitor O.S. air supply temperature from the ERV.

3. Provide dirty filter switch alarm on the ERV. Two switches.

3.3 START-UP AND COMMISSIONING

A. When installation of the system is complete, calibrate equipment and verify transmission media operation before the system is placed on-line. All testing, calibrating, adjusting and final field tests shall be completed by the manufacturer. Verify that all systems are operable from local controls in the specified failure mode upon panel failure or loss of power.

B. Provide any recommendation for system modification in writing to owner. Do not make any system modification, including operating parameters and control settings, without prior approval of owner.

C. After manufacturer has completed system start-up and commissioning. Joint commissioning of integrated system segments shall be completed. Equipment manufacturers must include necessary time for joint commissioning.

a. Start-Up and Check-out Procedures

The BACnet client supplier shall independently start-up, check-out and test all hardware and software and verify communication between all components of the BACnet client.

b. Joint Commissioning - Verify operation of the integrated system.

b1) Upon review of software, a point to point test of the integrated control installation shall commence. The BACnet client supplier representative in conjunction with the building control vendor shall test actual field operation of each control and sensing point. Compare the values read in the BACnet client and the Apogee system.

b2) When the point to point input/output testing is successfully completed, a series of hardware/software systems tests shall be performed. All groups of points that yield a system control shall be tested for compliance with the sequences of operation. The tests shall include but not be limited to:

a. Control interlocks and any miscellaneous sequences shall be tested.

b. All alarm and shutdown modes shall be tested for proper operation.

b3) The engineer and Owner may elect to be present to observe and review these tests. They shall be notified at least ten days in advance of the start of the testing procedures

3.4 ELECTRICAL WIRING AND MATERIALS

A. Install, connect and wire the items included under this Section. This work includes providing required conduit, wire, fittings, and related wiring accessories. All wiring shall be installed in conduit where required.

B. Provide wiring between thermostats, aquastats and unit heater motors, all control and alarm wiring for all control and alarm devices for all Sections of Specifications. Siemens wireless products/solutions are acceptable.

C. Provide 120 volt, single phase, 60 hertz emergency power to every B.M.S. DDC Controller panel, HVAC/Mechanical Equipment Controller, PC console, power supply, transformer, annunciator, modems, printers and to other devices as required. It is the intent that the entire building management system except terminal equipment shall be operative under emergency power conditions in the building. The power supplies are to be extended in conduit and wire from emergency circuit breakers.

D. Provide status function conduit and wiring for equipment covered under this Section.

E. Provide conduit and wiring between the B.M.S. panels and the temperature, humidity, or pressure sensing elements, including low voltage control wiring in conduit.

F. Provide conduit and control wiring for devices specified in this Section.

G. Provide conduit and signal wiring between motor starters in motor control centers and high and/or low temperature relay contacts and remote relays in B.M.S. panels located in the vicinity of motor control centers.

H. Provide conduit and wiring between the PC workstation, electrical panels, metering instrumentation, indicating devices, miscellaneous alarm points, remotely operated contractors, and B.M.S. panels, as shown on the drawings or as specified.

I. All wiring to be compliant to local building code and the NEC.

J. Provide electrical wall box and conduit sleeve for all wall mounted devices.

3.5 PERFORMANCE

A. Unless stated otherwise, control temperatures within plus or minus 2°F humidity within plus or minus 3% of the set point and static pressure within 10% of set point.

3.6 COMMISSIONING, TESTING AND ACCEPTANCE

A. Perform a three-phase commissioning procedure consisting of field I/O calibration and commissioning, system commissioning and integrated system program commissioning. Document all commissioning information on commissioning data sheets which shall be submitted prior to acceptance testing. Commissioning work which requires shutdown of system or deviation from normal function shall be performed when the operation of the system is not required. The commissioning must be coordinated with the owner and construction manager to ensure systems are available when needed. Notify the operating personal in writing of the testing schedule so that authorized personnel from the owner and construction manager are present throughout the commissioning procedure.

1. Prior to system program commissioning, verify that each control panel has been installed according to plans, specifications and approved shop drawings. Test, calibrate and bring on line each control sensor and device. Commissioning to include, but not be limited to:

a. Sensor accuracy at 10, 50 and 90% of range.

b. Sensor range.

c. Verify analog limit and binary alarm reporting.

d. Point value reporting.

e. Binary alarm and switch settings.

f. Actuator ranges.

g. Fail safe operation on loss of control signal, electric power, network communications.

B. After control devices have been commissioned (i.e. calibrated, tested and signed off), each BMS program shall be put on line and commissioned. The contractor shall, in the presence of the owner and construction manager, demonstrate each programmed sequence of operation and compare the results in writing. In addition, each control loop shall be tested to verify proper response and stable control, within specified accuracy's. System program test results shall be recorded on commissioning data sheets and submitted for record. Any discrepancies between the specification and the actual performance will be immediately rectified and retested.

C. After all BMS programs have been commissioned, the contractor shall verify the overall system performance as specified. Tests shall include, but not be limited to:

1. Data communication, both normal and failure modes.

2. Fully loaded system response time.

3. Impact of component failures on system performance and system operation.

4. Time/Date changes.

5. End of month/ end of year operation.

6. Season changeover.

7. Global application programs and point sharing.

8. System backup and reloading.

9. System status displays.

10. Diagnostic functions.

11. Power failure routines.

12. Battery backup.

13. Smoke Control, stair pressurization, stair, vents, in concert with Fire Alarm System testing.

14. Testing of all electrical and HVAC systems with other division of work.

D. Submit for approval, a detailed acceptance test procedure designed to demonstrate compliance with contractual requirements. This Acceptance test procedure will take place after the commissioning procedure but before final acceptance, to verify that sensors and control devices maintain specified accuracy's and the system performance does not degrade over time.

E. Using the commissioning test data sheets, the contractor shall demonstrate 10% of the total points. The contractor shall also demonstrate all system functions. The contractor shall demonstrate points and system functions until all devices and functions meet specification.

F. The contractor shall supply all instruments for testing and turn over same to the owner after acceptance testing.

1. All test instruments shall be submitted for approval.

Test Instrument Accuracy:

Temperature:	1/4F or 1/2% full scale, whichever is less.
Pressure:	High Pressure (psi): ½ psi or 1/2% full scale, whichever is less.
Low Pressure: (in w.c.)	1/2% of full scale
Humidity:	2% RH
Electrical:	1/4% full scale

G. After the above tests are complete and the system is demonstrated to be functioning as specified, a thirty day performance test period shall begin. If the system performs as specified throughout the test period, requiring only routine maintenance, the system shall be accepted. If the system fails during the test, and cannot be fully corrected within eight hours, the owner may request that performance tests be repeated.

3.7 EXISTING CONTROL DEVICES

A. The bid for the control work shall be based on the premise that existing control devices are operational and are not in need of repair or replacement, unless otherwise noted.

B. This subcontractor shall notify the owner's representative of existing control devices that need to be replaced or repaired that may be noted in the process of installation of the new work.

3.8 TRAINING

A. The manufacturer shall provide factory trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The manufacturer shall provide all students with a student binder containing product specific training modules for the system installed. The scheduling of training shall be coordinated through the Architect and OCMAPS Program

Consultant (The Facility Group). All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.

B. Provide up to two (2) each, four (4) hour training sessions for Owner's designated operating personnel. Training shall include:

Explanation of drawings, operations and maintenance manuals
Walk-through of the job to locate control components
Operator workstation and peripherals
DDC controller and ASC operation/function
Operator control functions including graphic generation and field panel programming
Operation of portable operator's terminal
Explanation of adjustment, calibration and replacement procedures
Student binder with training modules

C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Manufacturer. If such training is required by the Owner, it will be contracted at a later date.

----------END OF SECTION----------

	Programs										
	Time Scheduling	Holiday Scheduling	Smoke Cnt.	Enthalpy Opt.	Peak Demand Limiting	Dehumidification (4)	Status Information Required	Free Cooling	Heat/Cool Mode	Zone Control	Remote Notification
SCHOOLS											
Elementary School	x	x	x	x	x		x		x	x	x
AIR HANDLING UNITS											
Rooftop AHU	x	x	x	x	x	x	x	x	x	x	x
Exhaust Fans	x	x	x				x			x	
Heat Recovery Systems	x	x	x		x		x			x	
TERMINAL UNITS											
IT Room Unit											x

	Programs											
	Time Scheduling	Start/Stop Opt.	Holiday Scheduling	Smoke Cnt.	Enthalpy Opt.	Peak Demand Limiting	Dehumidification (4)	Status Information Required	Free Cooling	Heat/Cool Mode	Zone Control	Remote Notification
FIELD DEVICES												
Temperature								x (2)	x			x
Pressure								x (2)				x
Humidity	x (3)						x	x (2)				x
Air Flow												x
Setpoints (temp, pressure, Rh)	x					x						
CO2	x (3)	x (6)										x
Smoke												x
Damper Actuators												
Start/Stop/Status	x	x	x	x		x		x		x	x	
Lighting Systems	x		x			x (7)		x			x	
CONTROL SYSTEM COMPONENTS		x										
HVAC Equipment Integration Drivers	x		x			x					x	x
Floor Level Controllers												x
Building Level Controllers												x
Management Level Workstations												x

Foot notes > for discussion

(1)	Power back device for unoccupied or part load.
(2)	Analog/graphics display of select site point conditions
(3)	Trend logging of CO2 & humidity is desirable for I.A.Q. quality control and record keeping purposes. Unoccupied control and alarm set points may differ from occupied hours.
(4)	Dehumidification control loops to be applied on a zone level basis.
(5)	Some locations only.
(6)	O.A. off when unoccupied (w/ override capability)
(7)	Lighting level set back for peak demand control
(8)	Tower based, free cooling if heating season air conditioning is necessary.

	Alarms								Analog/Binary Points				
	Hi Analog	Low Analog	Hi Binary	Low Binary	Proof	Comm Fail	Alarm Instructions	Alarm Acknowledge	Trend	Local Command	Owner Adj. Zones	Global Command	Color Graphic
SCHOOLS													
Elementary School						x	x				x		x
AIR HANDLING UNITS													
Rooftop AHU										x	x	x	x
Exhaust Fans					x		x	x	x	x	x	x	x
Heat Recovery Systems													
TERMINAL UNITS													
IT Room Unit	x	x											x

	Alarms								Analog/Binary Points				
	Hi Analog	Low Analog	Hi Binary	Low Binary	Proof	Comm Fail	Alarm Instructions	Alarm Acknowledge	Trend	Local Command	Owner Adj. Zones	Global Command	Color Graphic
FIELD DEVICES													
Temperature	x	x					x	x	x	x		x	x
Pressure	x	x					x	x	x	x		x	x
Humidity	x	x					x	x	x	x		x	x
Air Flow	x	x	x	x	x		x	x	x	x		x	x
Setpoints (temp, pressure, Rh)	x	x							x	x		x	x
CO2	x	x					x	x	x	x		x	x
Smoke			x				x	x	x				x
Damper Actuators								x	x	x		x	x
Start/Stop/Status					x		x	x	x	x	x	x	x
Lighting Systems									x	x		x	x
CONTROL SYSTEM COMPONENTS													
HVAC Equipment Integration Drivers	x	x	x	x	x	x	x	x					
Floor Level Controllers						x	x						
Building Level Controllers						x	x	x					
Management Level Workstations						x	x	x					

	Reports				Diagnostics						Editors			Communication	
	Alarm Log	Event Report	Maintenance Log	Run Time	System Activity Utility	Database Upload/Download	Comm Diagnostics	Panel	Point	Program	Point	Program	Graphic	Ethernet TCP/IP	BACnet IP
SCHOOLS															
Elementary School	x	x	x	x	x		x	x	x	x	x	x	x	x	x
AIR HANDLING UNITS															
Rooftop AHU	x	x	x	x	x						x	x	x		
Exhaust Fans	x	x	x	x	x						x	x	x		
Heat Recovery Systems	x		x	x							x	x	x		
TERMINAL UNITS															
IT Room Unit	x	x	x	x	x						x	x	x		

	Reports				Diagnostics						Editors			Communication	
	Alarm Log	Event Report	Maintenance Log	Run Time	System Activity Utility	Database Upload/Download	Comm Diagnostics	Panel	Point	Program	Point	Program	Graphic	Ethernet TCP/IP	BACnet IP
SENSORS/DEVICES															
Temperature	X	X	X		X										
Pressure	X	X	X		X										
Humidity	X	X	X		X										
Air Flow	X	X	X		X										
Setpoints (temp, pressure, Rh)		X			X										
CO2	X	X	X		X										
Smoke	X	X	X		X										
Damper Actuators			X		X										
Start/Stop/Status	X	X	X	X	X				X	X	X	X	X		
Lighting Systems		X		X	X				X	X	X	X	X		
CONTROLLERS/EQUIPMENT															
HVAC Equipment Integration Drivers	X	X	X		X	X	X	X	X	X	X	X	X		
Floor Level Controllers	X	X	X		X	X	X	X	X	X	X	X	X		
Building Level Controllers	X	X	X		X	X	X	X	X	X	X	X	X	X	X
Management Level Workstations	X	X	X		X	X	X			X			X	X	X

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A Professional Corporation
Member: American Institute of Architects

ROOM FINISH SCHEDULE

FOR

OKLAHOMA CITY METROPOLITAN AREA PUBLIC SCHOOL TRUST

THELMA R. PARKS ELEMENTARY SCHOOL ADDITION/RENOVATION

1501 N.W. 30TH STREET
OKLAHOMA CITY, OKLAHOMA

Architect Project Number
N08079

OCMAPS Project Number
ES-0047

ROOM FINISH LEGEND

THELMA R. PARKS ELEMENATRY SCHOOL
OKLAHOMA CITY, OKLAHOMA

PROJECT NUMBER N08079
JANUARY 15, 2010

FLOORING

F1: VINYL TILE
MANUFACTURER: ARMSTRONG, STANDARD EXCELON
COLOR: 52513 CIRQUE WHITE
SIZE: 12" X 12"

F2: CARPET
MANUFACTURER: BIGELOW, ART ROOM
COLOR: MC143, 8565 HOBBYIST

F3: CERAMIC TILE
FIELD COLOR
MANUFACTURER: AMERICAN OLEAN
COLOR: A12 SALT AND PEPPER
ACCENT COLOR - GIRLS
MANUFACTURER: AMERICAN OLEAN
COLOR: A74 CHILI PEPPER SPECKLED
ACCENT COLOR - BOYS
MANUFACTURER: AMERICAN OLEAN
COLOR: A09 SAPPHIRE SKY SPECKLED

F4: SEALED CONCRETE

F5: PORCELAIN TILE
MANUFACTURE: AMERCAN OLEAN - TERRA PAVER
COLOR: TO BE SELECTED
SIZE: 12"X12"

CW: CLEAN AND PREP. FOR WAX

BASE

B1: RUBBER BASE
MANUFACTURER: ROPPE
COLOR: 139 DEEP NAVY
SIZE: 4"

B2: CERAMIC TILE BASE
MANUFACTURER: AMERICAN OLEAN
COLOR: A12 SALT AND PEPPER

B3: WOOD BASE
RED OAK
COLOR: NATURAL FINISH
SIZE: 4" MATCH EXISTING

WALLS

ROOM FINISH LEGEND

THELMA R. PARKS ELEMENATRY SCHOOL
OKLAHOMA CITY, OKLAHOMA

PROJECT NUMBER N08079
JANUARY 15, 2010

W1: LATEX PAINT

W2: CARPET WAINSCOTT TO BOTTOM OF WOOD RAIL IN CORRIDOR AREA ONLY
MANUFACTURER: BIGELOW -ART ROOM
COLOR: SELECT BY ARCHITECT

W3: CERAMIC TILE (TO 5'-6" HEIGHT) EPOXY PAINT TO 8" ABOVE CEILING HT.
FIELD COLOR
MANUFACTURER: AMERICAN OLEAN, BRIGHT
COLOR: 0045 SALT AND PEPPER
SIZE: 6" X 6"
ACCENT COLOR - GIRLS
MANUFACTURER: AMERICAN OLEAN
COLOR: Q072 POMEGRANATE
SIZE: 6" X 6"
ACCENT COLOR - BOYS
MANUFACTURER: AMERICAN OLEAN
COLOR: 0070 SAPPHIRE SKY
SIZE: 6" X 6"

W4: EPOXY PAINT TO 8" ABOVE CEILING HT.

CEILING

C1: 2'x4' LAY-IN ACOUSTICAL CEILING TILE

C2: 2'x4' MOISTURE RESISTANT LAY-IN ACOUSTICAL CEILING TILE

C3: PAINTED GYPSUM BOARD (ACRYLIC)

C4: PAINTED GYPSUM BOARD (EPOXY)

C5: EXPOSED STRUCTURE

C6: EXISTING 2'x4' CEILING REPLACE DAMAGED TILE (WITH MATCHING EXISTING TILES) PAINT TILES AND GRID.

CABINETS

PLAM: PLASTIC LAMINATE
MANUFACTURER: WILSONART CONTRACT FACTORY SPECIALS
COLOR: 7062-60 CONGO SPRUCE

ROOM FINISH LEGEND

THELMA R. PARKS ELEMENATRY SCHOOL
OKLAHOMA CITY, OKLAHOMA

PROJECT NUMBER N08079
JANUARY 15, 2010

COUNTER TOP

PLAM1: PLASTIC LAMINATE
MANUFACTURER: WILSONART LAMINATE
COLOR: 4651-60 NAVY LEGACY

DOORS

D1: NATURAL FINISH RED OAK

D2: HOLLOW METAL PAINTED (INTERIOR)

D3: FACTORY FINISH MATCHING EXISTING (EXTERIOR)

DOOR FRAME

DF1: HOLLOW METAL PAINTED (INTERIOR)

WINDOW FRAMES

WF1: HOLLOW METAL PAINTED (INTERIOR)

WF2: FACTORY FINISH (EXTERIOR)

WINDOW SILL

WS1: SYNTHETIC MARBLE

WINDOW COVERING

WC1: MINI BLINDS

WC2: METAL INSULATED PANEL

RESTROOM PARTITION
GIRLS
MANUFACTURER: GENERAL PARTITIONS
COLOR: 290 BORDEAUX
BOYS
MANUFACTURER: GENERAL PARTITIONS
COLOR: 220 COBALT

ROOM FINISH SCHEDULE

Thelma R. Parks Elementary School
Oklahoma City, Oklahoma

Project No.N08079
09/25/09

ROOM NAME	Administration	Art	Music	OP/PT
ROOM NUMBER	A101	A102	A103	A104
FLOOR	F1, F2	-	-	-
BASE	B1	B1	B1	B1
NORTH WALL	-	W1	W1	W1
SOUTH WALL	-	-	W1	W1
EAST WALL	-	-	-	W1
WEST WALL	-	W1	W1	W1
CEILING	-	C6	C6	C6
CEILING HEIGHT	-	-	-	-
CABINET	-	-	-	-
COUNTERTOP	-	-	-	-
DOOR	-	-	D1	-
DOOR FRAME	-	-	DF1	-
WIN. FRAME	-	-	-	-
WIN. SILL	-	-	-	-
WIN. COVERING	-	-	-	-
OTHER	-	-	-	-
NOTES	NOTE 1, 2	-	-	-

ROOM NAME	Art Storage	Kiln	Assistant Principal	Financial
ROOM NUMBER	A105	A106	A107	A108
FLOOR	-	-	F2	F2
BASE	B1	B1	B1	B1
NORTH WALL	W1	W1	W1	W1
SOUTH WALL	W1	W1	W1	W1
EAST WALL	W1	W1	W1	W1
WEST WALL	W1	W1	W1	W1
CEILING	C6	C3	C1	C1
CEILING HEIGHT	-	-	9'-0"	9'-0"
CABINET	-	-	PLAM	PLAM
COUNTERTOP	-	-	-	PLAM1
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	-	-	-	-
WIN. SILL	-	-	-	-
WIN. COVERING	-	-		-
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM FINISH SCHEDULE

ROOM NAME	General Storage	Counselor Office	Parent Resource	Corridor
ROOM NUMBER	A109	A110	A111	A112
FLOOR	F1	F2	F2	F1
BASE	B1	B1	B1	B1
NORTH WALL	W1	W1	W1	W1
SOUTH WALL	W1	W1	W1	W1
EAST WALL	W1	W1	W1	W1
WEST WALL	W1	W1	W1	W1
CEILING	C1	C1	C1	C1
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	9'-0"
CABINET	-	PLAM	PLAM	-
COUNTERTOP	-	-	PLAM1	-
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	-	-	-	-
WIN. SILL	-	-	-	-
WIN. COVERING	-	-		-
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM NAME	MDCC Special Needs	Psyc Area		
ROOM NUMBER	B108	B109		
FLOOR	CW	CW		
BASE	B1	-		
NORTH WALL	W1	W1		
SOUTH WALL	W1	W1		
EAST WALL	W1	W1		
WEST WALL	W1	W1		
CEILING	C1	C1		
CEILING HEIGHT	9'-0"	9'-0"		
CABINET	PLAM	PLAM		
COUNTERTOP	PLAM1	PLAM1		
DOOR	D1	D1		
DOOR FRAME	DF1	DF1		
WIN. FRAME	-			
WIN. SILL	-			
WIN. COVERING	-			
OTHER	-			
NOTES	-			

ROOM FINISH SCHEDULE

ROOM NAME	Restroom			
ROOM NUMBER	D110			
FLOOR	F3			
BASE	B2			
NORTH WALL	W3,W1			
SOUTH WALL	W3,W1			
EAST WALL	W3,W1			
WEST WALL	W3,W1			
CEILING	C4			
CEILING HEIGHT	9'-0"			
CABINET	-			
COUNTERTOP	-			
DOOR	D1			
DOOR FRAME	DF1			
WIN. FRAME	-			
WIN. SILL	-			
WIN. COVERING	-			
OTHER	-			
NOTES	-			

ROOM NAME	MDCC Special Needs	MDF Closet	Speach Area	
ROOM NUMBER	E107	E108	E109	
FLOOR	CW	CW	CW	
BASE	-	-	-	
NORTH WALL	W1	W1	W1	
SOUTH WALL	W1	W1	W1	
EAST WALL	W1	W1	W1	
WEST WALL	W1	W1	W1	
CEILING	C1	C1	C1	
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	
CABINET	PLAM	-	-	
COUNTERTOP	PLAM1	-	-	
DOOR	D1	D1	D1	
DOOR FRAME	DF1	DF1	DF1	
WIN. FRAME	-	-	-	
WIN. SILL	-	-	-	
WIN. COVERING	-	-	-	
OTHER	-	-	-	
NOTES	-	-	-	

ROOM FINISH SCHEDULE

ROOM NAME	Classroom	Classroom	Classroom	Classroom
ROOM NUMBER	F101	F102	F103	F104
FLOOR	F1	F1	F1	F1
BASE	B1	B1	B1	B1
NORTH WALL	W1	W1	W1	W1
SOUTH WALL	W1	W1	W1	W1
EAST WALL	W1	W1	W1	W1
WEST WALL	W1	W1	W1	W1
CEILING	C1	C1	C1	C1
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	9'-0"
CABINET	PLAM	PLAM	PLAM	PLAM
COUNTERTOP	PLAM1	PLAM1	PLAM1	PLAM1
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	WF2	WF2	WF2	WF2
WIN. SILL	WS1	WS1	WS1	WS1
WIN. COVERING	WC1	WC1	WC1	WC1
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM NAME	Classroom	ESL Storage	Classroom	Classroom
ROOM NUMBER	F105	F106	F107	F108
FLOOR	F1	F1	F1	F1
BASE	B1	B1	B1	B1
NORTH WALL	W1	W1	W1	W1
SOUTH WALL	W1	W1	W1	W1
EAST WALL	W1	W1	W1	W1
WEST WALL	W1	W1	W1	W1
CEILING	C1	C1	C1	C1
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	9'-0"
CABINET	PLAM	PLAM	PLAM	PLAM
COUNTERTOP	PLAM1	PLAM1	PLAM1	PLAM1
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	WF2	WF2	WF2	WF2
WIN. SILL	WS1	WS1	WS1	WS1
WIN. COVERING	WC1	WC1	WC1	WC1
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM FINISH SCHEDULE

ROOM NAME	Classroom	Self Contained SN	Resource Rm. SN	Health Area SN
ROOM NUMBER	F109	F110	F111	F112
FLOOR	F1	F1	F1	F1
BASE	B1	B1	B1	B1
NORTH WALL	W1	W1	W1	W1
SOUTH WALL	W1	W1	W1	W1
EAST WALL	W1	W1	W1	W1
WEST WALL	W1	W1	W1	W1
CEILING	C1	C1	C1	C1
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	9'-0"
CABINET	PLAM	PLAM	PLAM	PLAM
COUNTERTOP	PLAM1	PLAM1	PLAM1	PLAM1
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	WF2	WF2	WF2	-
WIN. SILL	WS1	WS1	WS1	-
WIN. COVERING	WC1	WC1	WC1	-
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM NAME	Restroom	Mobile Labs	Electrical	Janitor
ROOM NUMBER	F113	F114	F115	F116
FLOOR	F3	F1	F4	F4
BASE	B2	B1	B1	B1
NORTH WALL	W3	W1	W1	W4
SOUTH WALL	W3	W1	W1	W4
EAST WALL	W3	W1	W1	W4
WEST WALL	W3	W1	W1	W4
CEILING	C4	C1	C1	C4
CEILING HEIGHT	9'-0"	9'-0"	-	9'-0"
CABINET	-	-	-	-
COUNTERTOP	-	-	-	-
DOOR	D1	D1	D1	D1
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	-	-	-	-
WIN. SILL	-	-	-	-
WIN. COVERING	-	-	-	-
OTHER	-	-	-	-
NOTES	-	-	-	-

ROOM FINISH SCHEDULE

ROOM NAME	Girls	Boys	Corridor	Corridor
ROOM NUMBER	F117	F118	F119	F120
FLOOR	F3	F3	F1	F1
BASE	B2	B2	B3	B3
NORTH WALL	W3	W3	W1,W2	W1,W2
SOUTH WALL	W3	W3	W1,W2	W1,W2
EAST WALL	W3	W3	W1,W2	W1,W2
WEST WALL	W3	W3	W1,W2	W1,W2
CEILING	C4	C4	C1	C1
CEILING HEIGHT	9'-0"	9'-0"	9'-0"	9'-0"
CABINET	-	-	-	-
COUNTERTOP	-	-	-	-
DOOR	D1	D1	D3	D3
DOOR FRAME	DF1	DF1	DF1	DF1
WIN. FRAME	-	-	-	-
WIN. SILL	-	-	-	-
WIN. COVERING	-	-	-	-
OTHER	-	-	-	-
NOTES	-	-	-	

ROOM NAME	Corridor	Office/Work SN		
ROOM NUMBER	F121	F122		
FLOOR	F1	F1		
BASE	B3	B1		
NORTH WALL	W1,W2	W1		
SOUTH WALL	W1,W2	W1		
EAST WALL	W1,W2	W1		
WEST WALL	W1,W2	W1		
CEILING	C1	C1		
CEILING HEIGHT	9'-0"	9'-0"		
CABINET	-	-		
COUNTERTOP	-	-		
DOOR	D3	D1		
DOOR FRAME	DF1	DF1		
WIN. FRAME	-	-		
WIN. SILL	-	-		
WIN. COVERING	-	-		
OTHER	-	-		
NOTES	-	-		

KEYED NOTES FOR ROOM FINISH SCHEDULE:

1. FOR ROOMS IN ADMINISTRATION TO RECEIVE NEW FLOOR FINISH REF. SHEET 3A3
2. ENTRY VESTIBULE RECEIVES NEW PORCELAIN TILE AND WOOD BASE REF. SHEET 3A3

BWA
BOYNTON-WILLIAMS & ASSOCIATES

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DOOR SCHEDULE

FOR
OKLAHOMA CITY METROPOLITAN AREA PUBLIC SCHOOL TRUST
THELMA R. PARKS ELEMENTARY SCHOOL ADDITION/RENOVATION

1501 N.W. 30TH STREET
OKLAHOMA CITY, OKLAHOMA

Architect Project Number
N08079

OCMAPS Project Number
ES-0047

DOOR SCHEDULE

Thelma R. Parks Elementary School Addition and Renovation **N08079**

Oklahoma City, Oklahoma **March 4, 2010**

DOOR #	TO	FROM	WIDTH	HEIGHT	THCK	MAT'L	FRAME ELEV	RAT'G	DOOR ELEV	HEAD	JAMB 1	JAMB 2	THRESH	SIGNAGE	HDW SET	NOTES
A100A	ENTRY	VEST.	PR. 3'-0"	7'-0"	1 3/4"	ALUM	F4		2	M/5A3	L/5A3	N/5A3	E/5A3		1	1
A100B	A101	VEST.	3'-0"	7'-0"	1 3/4"	ALUM	F5		4	P/5A3 SIM.	O/5A3	P/5A3	F2/5A3		9	
A100C	A100	EXT	EXIST	EXIST	-	-	EXIST		EXIST							1
A103A	A103	A100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	P/5A3 SIM.	P/5A3	P/5A3	E/5A3	MUSIC	10	
A104A	A104	A100	EXIST	EXIST	-	-	EXIST		EXIST					OP/PT AREA		
A105A	A105	A102	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	ART STORAGE	5	
A106A	A106	A102	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	KILN	5	
A107A	A107	A112	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	VICE PRINCIPAL	7	
A108A	A108	A112	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	FINANCIAL	7	
A109A	A109	A112	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	GENERAL STORAGE	5	
A110A	A110	A112	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	R/5A3	G/5A3	E/5A3	GUIDANCE COUNSELOR	7	
A111A	A111	A100	EXIST	EXIST	-	-	EXIST		EXIST					PARENT RESOURSE		
A112A	A112	A100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	K/5A3	G/5A3	E/5A3	ADMINISTRATION	8	
B108A	B108	B100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	MDCC	7	
B109A	B109	B100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	PSYCH AREA	7	
D100A	REC'G	DOCK	EXIST	EXIST	-	-	EXIST		EXIST							1
D100B	D100	EXT	EXIST	EXIST	-	-	EXIST		EXIST							1
D110A	D110	D102	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	G/5A3	E/5A3	RESTROOM	11	
E107A	E107	E100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	MDCC	7	
E108A	E108	D101	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	P/5A3 SIM.	P/5A3	P/5A3	E/5A3	MDF CLOSET	5	
E109A	E109	E100	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	K/5A3	E/5A3	SPEECH AREA	7	
F101A	F101	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	CLASSROOM	7	
F102A	F102	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	T/5A3	S/5A3	E/5A3	CLASSROOM	7	
F103A	F103	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	CLASSROOM	7	
F104A	F104	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	T/5A3	S/5A3	E/5A3	CLASSROOM	7	
F105A	F105	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	T/5A3	S/5A3	E/5A3	CLASSROOM	7	
F106A	F106	F119	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	CLASSROOM	7	
A106B	CLOSET	A106	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	G/5A3	E/5A3		5	
F107A	F107	F119	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	CLASSROOM	7	
F108A	F108	F119	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	T/5A3	S/5A3	E/5A3	CLASSROOM	7	
F109A	F109	F119	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	CLASSROOM	7	
F110A	F110	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	T/5A3	S/5A3	E/5A3	SPECIAL NEEDS	7	
F111A	F111	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	Q/5A3	S/5A3	T/5A3	E/5A3	SPECIAL NEEDS	7	

DOOR SCHEDULE

Thelma R. Parks Elementary School Addition and Renovation
Oklahoma City, Oklahoma

N08079
March 4, 2010

DOOR #	TO	FROM	WIDTH	HEIGHT	THCK	MAT'L	FRAME ELEV	RAT'G	DOOR ELEV	HEAD	JAMB 1	JAMB 2	THRESH	SIGNAGE	HDW SET	NOTES
F112A	F112	F110	3'-0"	7'-0"	1 3/4"	SCWD	F1		3	H/5A3	K/5A3	G/5A3	E/5A3	HEALTH AREA	7	
F113A	F113	F110	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	R/5A3	E/5A3	RESTROOM	11	
F114A	F114	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	Q/5A3	S/5A3	S/5A3	E/5A3	MOBILE LAB	6	
F115A	F115	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	Q/5A3	T/5A3	S/5A3	E/5A3	ELECTRICAL	6	
F116A	F116	F120	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	Q/5A3	S/5A3	T/5A3	E/5A3	JANITOR	6	
F117A	F117	F119												GIRLS		
F117B	CHASE	F119	2'-4"	7'-0"	1 3/4"	SCWD	F1		1	V/5A3	U/5A3	U/5A3	F1/5A3		6	
F118A	F118	F119												BOYS		
F119A	F119	EXT	PR 3'-0"	7'-0"	1 3/4"	ALUM	F2		2	D/5A3 SIM.	C/5A3 SIM.	C/5A3 SIM.	A1/5A3		3	2
F121A	F121	EXT	PR 3'-0"	7'-0"	1 3/4"	ALUM	F2		2	D/5A3 SIM.	C/5A3 SIM.	S/2A3	A1/5A3		2	1, 2
F122A	F122	F111	3'-0"	7'-0"	1 3/4"	SCWD	F1		1	H/5A3	G/5A3	G/5A3	E/5A3	WORKROOM	7	

Keyed Notes to Door and Sign Schedule

1. CARDKEY ACCESS
2. COORIDOR SIGNAGE TO INCLUDE 2 DIRECTIONAL SIGNS AND 3 CORRIDOR SIGNS REF. SPECS.

BOYNTON-WILLIAMS & ASSOCIATES

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GEOTECHNICAL REPORT

FOR

OKLAHOMA CITY METROPOLITAN AREA PUBLIC SCHOOL TRUST

THELMA R. PARKS ELEMENTARY SCHOOL ADDITION/RENOVATION

1501 N.W. 30TH STREET
OKLAHOMA CITY, OKLAHOMA

Architect Project Number
N08079

OCMAPS Project Number
ES-0047

SUBSURFACE EXPLORATION

OCMAPS ES- 0047
Thelma R. Parks Elementary School Building Addition
1501 N.E. 30th Street
Oklahoma City, Oklahoma

PROJECT NO. 0309-3097

STANDARD TESTING
AND ENGINEERING COMPANY
Since 1951

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June 26, 2009

Oklahoma City Metropolitan Area Public Schools Trust
420 W. Main
Oklahoma City, OK 73102

Attn: Mr. Eric Wenger, P.E.
Program Manager

Re: Subsurface Exploration
OCMAPS ES-0047, Thelma R. Parks Elementary School Building Addition
1501 N.E 30th Street
Oklahoma City, Oklahoma 73111

Dear Mr. Wenger:

Enclosed herewith are the original and two (2) copies of our report covering the subsurface exploration for the subject project. This study was authorized by a letter signed by Mr. Eric J. Wenger, dated May 21, 2009.

Standard Testing and Engineering Company conducted a geotechnical investigation at the site of a new building addition for Thelma R. Parks Elementary School located at 1501 N.E. 30th Street, Oklahoma City, Oklahoma. This report contains detailed results of the investigation, including foundation recommendations, as well as construction considerations.

The subsurface soils consist of approximately 2.5 to 15 feet of nonplastic to fairly low plasticity silty sand, sandy clay, and sandy shale over siltstone (rock) and sandy shale (rock).

Foundation recommendations include either (1) shallow footings or (2) cast-in-place concrete piers.

We trust that the results and recommendations contained herein will permit adequate economical design and construction of the proposed structure. Unless you specify otherwise, we will keep samples obtained from these borings in our Oklahoma City laboratory for the next thirty (30) days.

We appreciate the opportunity to assist on this project. Please call on us if we can be of further service.

Respectfully submitted,
STANDARD TESTING AND ENGINEERING COMPANY

Vajra Rai
Staff Geotechnical Engineer

Project No. 0309-3097
Account No. 0230OKC18

This document is preliminary in nature and is not a final, signed and sealed document.

SUBSURFACE EXPLORATION

OCMAPS ES- 0047
Thelma R. Parks Elementary School Building Addition
1501 N.E. 30th Street
Oklahoma City, Oklahoma

PROJECT NO. 0309-3097

PREPARED FOR

Oklahoma City Metropolitan Area Public Schools Trust
420 W. Main
Oklahoma City, OK 73102

PREPARED BY

STANDARD TESTING AND ENGINEERING COMPANY
3400 N. Lincoln Blvd.
Oklahoma City, OK 73105
Certificate of Authorization No. 77, Expiration 6/30/09
(405) 528-0541

Prepared By:

Vajra Rai
Staff Geotechnical Engineer

Reviewed By:

Ming-Cheng Peter Shau, P.E.
Manager, Geotechnical Services

June 26, 2009

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Section 1

INTRODUCTION

Authorization

This report presents the results of a subsurface exploration performed by Standard Testing and Engineering Company (Standard Testing) in accordance with the proposal prepared for Oklahoma City Metropolitan Area Public Schools Trust, dated April 29, 2009, and identified as Standard Testing project number 0309-3097. We received authorization for this study through a letter signed by Mr. Dennis Clowers, Director of Public Works/City Engineer and Mr. Eric J. Wenger, Program Manager of Oklahoma City Metropolitan Area Public Schools Trust, dated May 21, 2009.

Purpose and Scope

A geotechnical investigation was performed for the purpose of (1) determining the subsurface conditions, (2) evaluating the bearing capacity and plasticity characteristics of the soils, and (3) making recommendations concerning the earthwork and foundation systems for the proposed facility.

Five (5) exploratory borings were drilled on the site as requested by Mr. Wenger. The depths of the borings, and types of testing were performed according to the scope of work proposed by Standard Testing and accepted by Mr. Wenger. Narrative descriptions of our findings and recommendations are contained in the body of this report. A site and boring location plan, the boring logs, and summary of laboratory test results are included in the Appendices of this report.

Project Location and Description

The proposed project will be a single story building addition to Thelma R. Parks Elementary School located at 1501 N.E. 30th Street in Oklahoma City, Oklahoma. The addition is located on the west side of the existing elementary school building. The anticipated column and wall loads were not known while this report was written.

If the project is not as described or has changed, Standard Testing must be notified in order to reevaluate the recommendations for the project.

Section 2

FIELD EXPLORATION

Drilling Information

The field exploration work was performed and completed on June 3 and 8, 2009.

Conditions at the site were investigated with five (5) borings at the locations indicated on the site and boring location plan, included in Appendix "A." Boring depths ranged from 16.5 to 20.0 feet within the building addition footprint. Surface elevation of the borings were measured relative to the finish floor elevation of the existing school building. This temporary benchmark was assigned a reference elevation of 100.0 feet. For accurate sampling, cuttings were observed continuously during drilling with specific samples being taken at distinct lithologic changes. The equipment used, field tests performed, and soil samples taken are discussed below.

Equipment

- Five (5) borings were dry drilled with a truck-mounted CME-55 rotary drilling unit equipped with 3.25" I.D. X 7.25" O.D. hollow stem augers. Standard penetration tests (SPT) used a 1.375" ID split-spoon sampler driven by an automatic hammer utilizing a 140 lb. weight falling 30 inches.

Tests Performed

- Twenty-one (21) standard penetration tests were performed in order to estimate the shear strengths of the soils in their natural state. The test was conducted as specified by ASTM D1586, "Penetration Test and Split Barrel Sampling of Soils." The in-situ shear strength of a soil is related to the N-value from this test. "N" is the number of blows required to drive a split-spoon sampler twelve inches, after a 6 inch seating, into undisturbed soil. The soil samples recovered in the split-spoon barrel were removed from the sample tool in the field, visually classified, and labeled according to boring number and depth. Results of the

standard penetration tests are denoted at their respective depths on the boring logs.

Depths of individual standard penetration tests and grab samples are indicated on the boring logs included in Appendix "B." Split- spoon and grab (bag) samples were labeled and sealed in water tight, protective containers and returned to the laboratory for further evaluation and testing.

Subsurface Conditions

The soils encountered consist of silty sand, sandy clay, and sandy shale over siltstone (rock) and sandy shale (rock). These near surface soils exhibit nonplastic to fairly low plasticity characteristics. Rock material (i.e., defined by standard penetration test refusal, SPT "N" value of 50 blows per 6 inches or less penetration) was encountered in the borings at the relative elevations indicated in the following table:

Relative Elevation of Rock Material				
Boring No.	Relative Surface Elevation (feet)	Depth (feet)	Relative Elevation (feet)	Rock Material
B-1	98.1	2.5	95.6	Siltstone
B-2	97.3	5.0	92.3	Siltstone
B-3	97.3	2.5	94.8	Siltstone
B-4	95.2	10.5	84.7	Sandy Shale
B-5	99.6	15.5	84.1	Sandy Shale

Groundwater

During the drilling operation, groundwater was encountered in the indicated borings at the depths shown in the Relative Elevation of Groundwater table. Presence of water should be anticipated in any excavation. Water traveling through soil (subsurface water) is often unpredictable and may be present at shallow depths. Due to the seasonal changes in groundwater and the unpredictable nature of groundwater paths, groundwater levels will fluctuate. Therefore, it is necessary during construction to

be observant for groundwater seepage in excavations in order to assess the situation and make necessary changes. We cannot assume responsibility for difficulties experienced during construction or for future operational problems due to relative elevation or volume of water encountered.

Relative Elevation of Groundwater			
Boring No.	Relative Surface Elevation (feet)	Depth (feet)	Relative Elevation (feet)
B-1	98.1	5.0	93.1
B-2	97.3	5.0	92.3
B-3	97.3	12.0	85.3
B-4	95.2	12.0	83.2
B-5	99.6	15.0	84.6

Section 3

LABORATORY TESTING

Laboratory testing was performed in order to determine the plasticity characteristics of the subsurface materials as well as confirm the soil classifications. General descriptions of the encountered soils together with visual and laboratory classifications and numerical values of the test results are on the boring logs included in Appendix "B." A "Summary of Laboratory Test Results" is included in Appendix "D."

Tests Performed

- Moisture content tests were performed on split-spoon and bag samples, in accordance with ASTM D2216, to determine the in-situ moisture conditions.
- Density tests were performed on intact split-spoon samples in accordance with AASHTO T233.
- Atterberg limits tests were performed on six (6) soil samples to determine the plasticity characteristics and swell potential of the soil. The tests were performed in accordance with ASTM D4318.
- Sieve analysis was performed on two (2) soil samples, in accordance with ASTM D2487, for aid in classification. These soils were classified according to the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system.

This document is preliminary in nature and is not a final, signed and sealed document.

Section 4

ENGINEERING EVALUATION AND RECOMMENDATIONS

Soil Conditions

The soils encountered in this investigation consist of silty sand, sandy clay, and sandy shale over siltstone (rock) and sandy shale (rock). The cohesionless soils were found to have a very loose to medium dense relative density and the cohesive soils were found to be soft to very stiff in consistency. The underlying rock siltstone and sandy shale exhibits SPT refusal (i.e., SPT "N" value of 50 blows per 6 inches or less penetration) at the relative elevations indicated in the " Relative Elevation of Rock Material" table in section 2 of this report. The plasticity characteristics of the soils encountered indicate that these soils are inactive for consideration of soil expansion on foundation design.

Seismic Site Class

Based on the results of our investigation, this site is classified as Seismic Site Class D. This recommendation is based on the criteria given in Table 1613.5.2 of the International Building Code (IBC) 2006, entitled "Site Class Definitions."

Earthwork Recommendations

Only nonplastic to low plasticity on-site soils or imported inert fill should be used for fill under structure. Inert fill should meet the following requirements:

Inert Fill Requirements

Amount finer than 2 inch sieve	= 100%
Amount finer than No. 200 sieve	= 12% minimum and, if PI ≤7, 60% maximum
Liquid Limit	= 40 maximum
Plasticity Index (PI)	= 17 maximum

Subgrade Preparation

The existing subgrade should be:

- stripped of all vegetation, topsoil, and any other deleterious materials,
- proofrolled, including removing and replacing any soft material which exhibits permanent subgrade deformation exceeding 0.5 inch when traversed by a loaded truck with a rear axle load of approximately 16,000 lbs./axle,
- tested for moisture and density and, if deficient, scarified to a depth of 8 inches, moisture conditioned to within -2 to +4 percentage points of optimum moisture, and compacted to 95 percent or more of standard Proctor maximum dry density (ASTM D698).

Removal of soft subgrade should not exceed a 3 foot depth below final top of subgrade elevation, nor extend below the static groundwater elevation. If such a depth is reached without encountering stable subgrade conditions, 12 inches of ODOT Type A or Type B aggregate base should be placed in the bottom of the overexcavated area and suitable fill material placed and compacted to bring the subgrade to design elevation.

Compaction Requirements

All fill in the structural area should be:

- compacted to at least 95 percent of standard Proctor maximum dry density (ASTM D698) at a moisture content within -2% to +4% of the optimum.
- placed in lifts not to exceed eight (8) inches in compacted thickness.
- tested for field density for each lift of fill at frequencies of every 5000 sq. ft. in areas under structure.

Moisture should be maintained up until the placement of concrete, especially in structural area, to prevent shrinkage (and subsequent post-construction swell) of the soil.

Drainage

All areas adjacent to the building should be sloped away from the structure to prevent ponding of water near the building.

Foundation Recommendations

Considering the soils encountered and based on the test results of this exploration, the following foundation design parameters are recommended for the indicated foundation systems:

A. Footing Foundation System

Shallow foundations (e.g., spot or continuous cast-in-place concrete footings) may be used at this site. Footings must be placed a minimum of 2.0 feet below finished grade to provide adequate protection from frost action. Footings may be used with an allowable net bearing capacity of 2,500 psf if bearing in undisturbed native soil or the compacted inert fill or stabilized subgrade as specified in the Earthwork Recommendations section of this report. Footings should have a width of at least 16 inches.

Footings are expected to undergo no more than 1.0 inch settlement when designed for the recommended bearing pressure.

B. Pier Foundation System

A satisfactory foundation alternative to shallow spread footings may be the use of drilled cast-in-place concrete piers founded 2.0 feet or more below the depths indicated in the "Relative Elevation of Rock Material" table provided in Section 2 of this report. Using this type of foundation, each column is supported on a single drilled pier and the building walls are placed on grade beams supported by a series of piers. Loads applied to the piers are transmitted to the rock partially through skin friction along the sides of the pier and partially through end bearing pressure.

All drilled piers should:

- extend at least 2.0 feet or at least one (1) pier diameter, whichever is greater, below the depths and elevations indicated in the "Relative Elevation of Rock Material",
- have an aspect ratio (length/diameter) of four (4) or more.
- have a spacing between individual piers of three diameters or more (clear spacing).
- be adequately reinforced with the reinforcement extending into the grade beams and/or pier caps.

Piers may be proportioned using an allowable net end bearing capacity of 14,000 psf and an allowable skin friction capacity of 1,080 psf for that portion of the pier in direct contact with the sandy shale (rock) formations. Skin friction along the shaft in the overlying soils should be ignored. Uplift on the piers can be resisted by using this same skin friction value plus an allowance for pier weight. Maximum vertical displacement of piers designed in this manner is expected to be on the order of 0.7% of the pier base diameter.

Drilled shafts will require casing or slurry-drilling methods. Concrete should be placed in pier holes as soon as practicable after completion of drilling to prevent weathering of the bearing stratum and relaxation of horizontal ground stresses. If the pier holes cannot be dewatered, concrete must be placed by tremie method so as to assure no contamination of the fresh concrete by groundwater or drilling fluids. A sufficient head of plastic concrete should be maintained within the casing at all times during its extraction in order to overcome the hydrostatic groundwater pressure outside the casing.

Floor Slabs

Concrete slabs-on-grade floors for shallow foundation should be constructed as follows:

- The subgrade, inert fill, or stabilized soil building pad should be prepared as described in the Earthwork Recommendations section of this report.
- Four (4) inches or more of granular base, meeting the following requirements, should be placed over the subgrade:

  passing the 1.5 inches sieve ..... 100 %

  passing the #200 sieve ..... 15 % or less

  plasticity index ..... 6 or less
- At the time of concrete placement, the granular base should be moist, but free of any self-draining water.
- The concrete slab should be placed a minimum of four (4) inches thick in lightly loaded areas and up to six (6) inches thick in heavily loaded areas and should not be tied into the footings, stemwalls, or structural frame. If it is necessary to tie the floor slab into the foundation walls, exterior walls, and/or pitwalls, the floor should be jointed no more than 10 to 15 feet from the point of the restraint (ACI 360R-92, Section 9.7). Other control joints should be provided, each way, at a spacing of 24 to 36 times the slab thickness but no more than 18 feet (ACI 302.1R-04, section 3.2.5.3).

If floor coverings susceptible to moisture damage by moist floor conditions (capillary moisture) are to be used, a vapor retarder consisting of one or more polyethylene or polypropylene fabric reinforcement layers with one or more bonded polyethylene film layers, at least 10 mils in total thickness, should be placed below the slab. The vapor retarder should be lapped 6 inches and taped at joints and fitted around all service openings. Section 3.2.3 of ACI 302.1R-04 provides the most current industry recommendations for use and placement of vapor retarders. Figure 3.1, in ACI 302.1R-04, provides guidance for determining whether to place the vapor retarder above or below the "granular material" below the slab.

Floor slabs can be designed using a modulus of subgrade reaction, k_s, of 150 pci for native soil or inert fill or stabilized subgrade described in the Earthwork Recommendations section of this report.

Basis for Recommendations

The recommendations and conclusions contained in this report are based on the borings drilled and tests performed. We would point out that there may be variations in material properties over the site, and would caution that there may be unknown conditions in existence which differ seriously from those encountered by the test borings. Such conditions, if indeed they exist at all, cannot be, and have not been, accounted for in this report. Therefore, the descriptions, recommendations, and conclusions contained herein should be considered as generalized, applying only to the immediate vicinity of the borings.

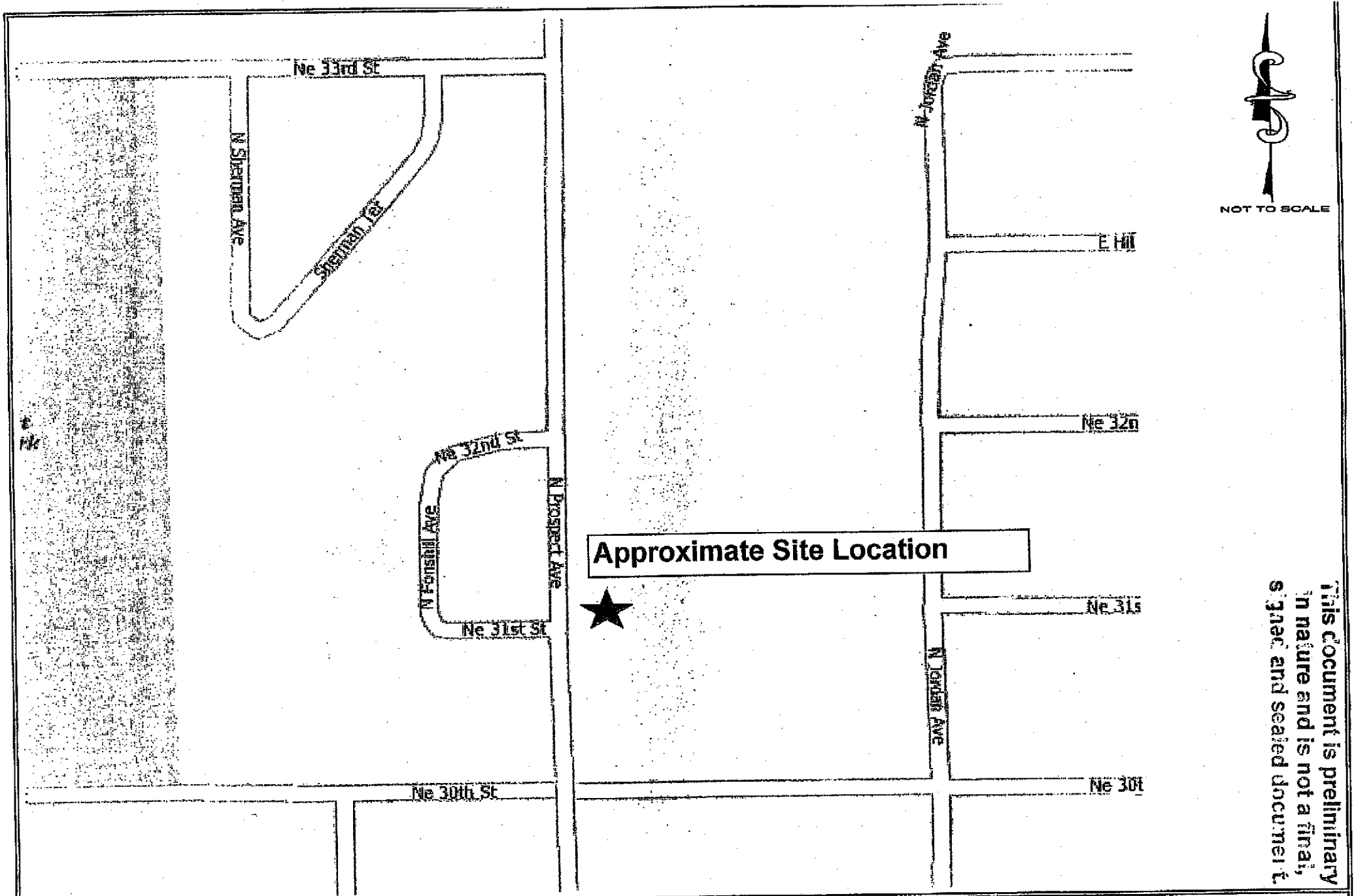
Since this report is being prepared in advance of much of the detailed design, the finalized soil and structure parameters (i.e., floor elevation, fill and cut provisions, structural system and loading, vertical movement tolerance, etc.) may differ from the ones considered during the preparation of this report. If such a design variance is substantial, Standard Testing would request the opportunity to review the plans and specifications of the proposed facility for applicability to the soil conditions in this report, and assurance of consistency with its intent.

It is recommended that Standard Testing be retained for testing and observation during earthwork and foundation construction phases, to help determine that the design requirements are fulfilled. It is also recommended that Standard Testing's pier inspector be present during the pier drilling operations to verify the hardness of the support soil stratum and the proper depth of embedment.

This report has been prepared for the exclusive use of our client for specific application to the project discussed, and has been prepared in accordance with generally accepted geotechnical practice.

APPENDIX A

Vicinity Map
Site and Boring Location Plan



This document is preliminary in nature and is not a final, signed and sealed document.

Vicinity Map

Project Name: OCMAPS ES-0047, Thelma R. Parks Elementary School Building Addition
Project Location: 1501 N.E., 30th Street, Oklahoma City, OK
Project No.: 0309-3097

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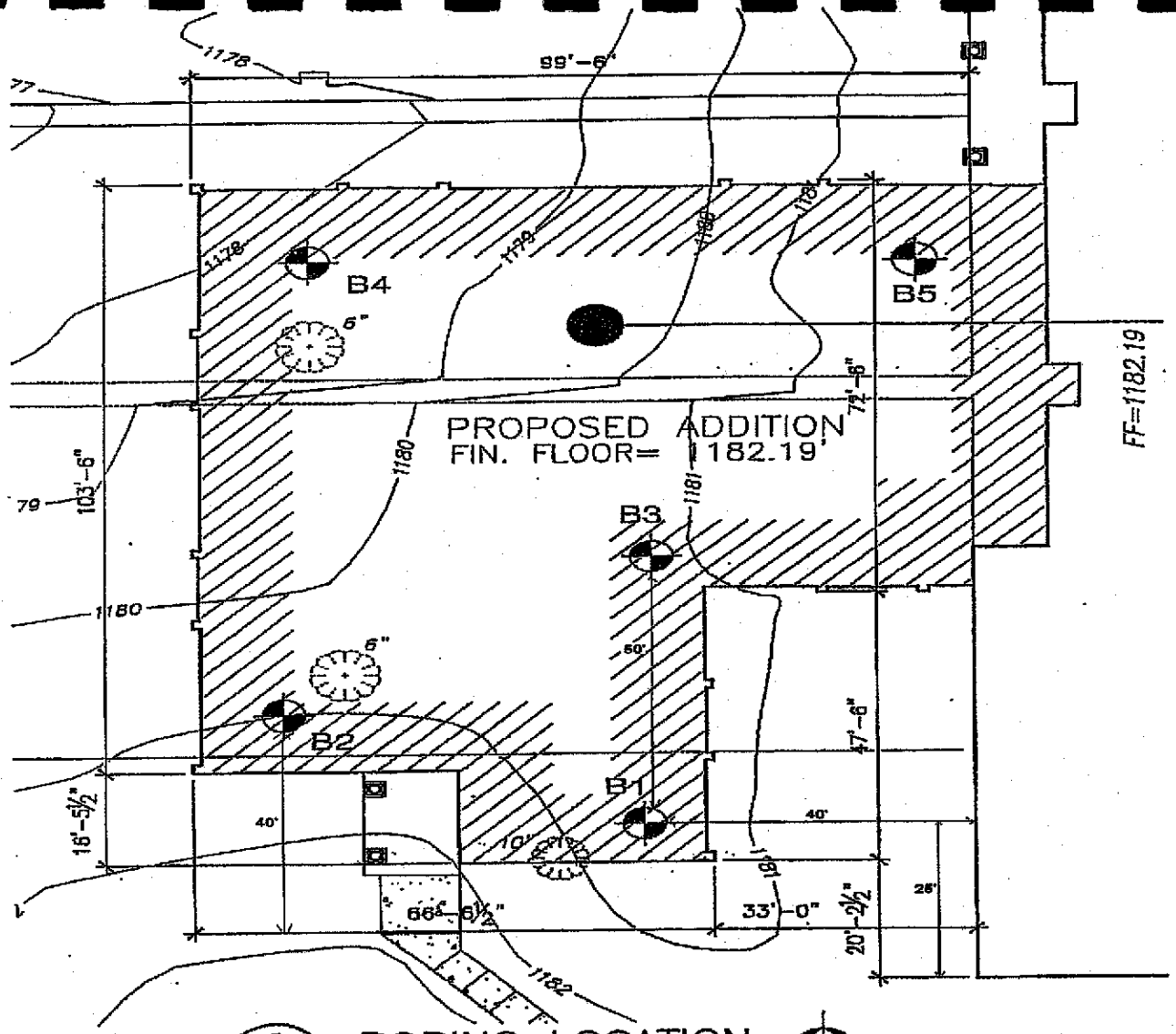

A/2 BORING LOCATION
SCALE: 1"= 20'-0" 04/27/09

N
Not to Scale

Legend:

⊕ – Approximate Boring Location

BM: F.F. of existing school building

In nature and is not a fra
signed and sealed document.

Site and Boring Location Plan

Project Name: OCMAPS ES-0047, Thelma R. Parks Elementary School Building Addition
Project Location: 1501 N.E., 30th Street, Oklahoma City, OK
Project No.: 0309-3097

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APPENDIX B

Boring Logs
Key to Symbols
Definition of Descriptive Terms

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GEOTECHNICAL SERVICES

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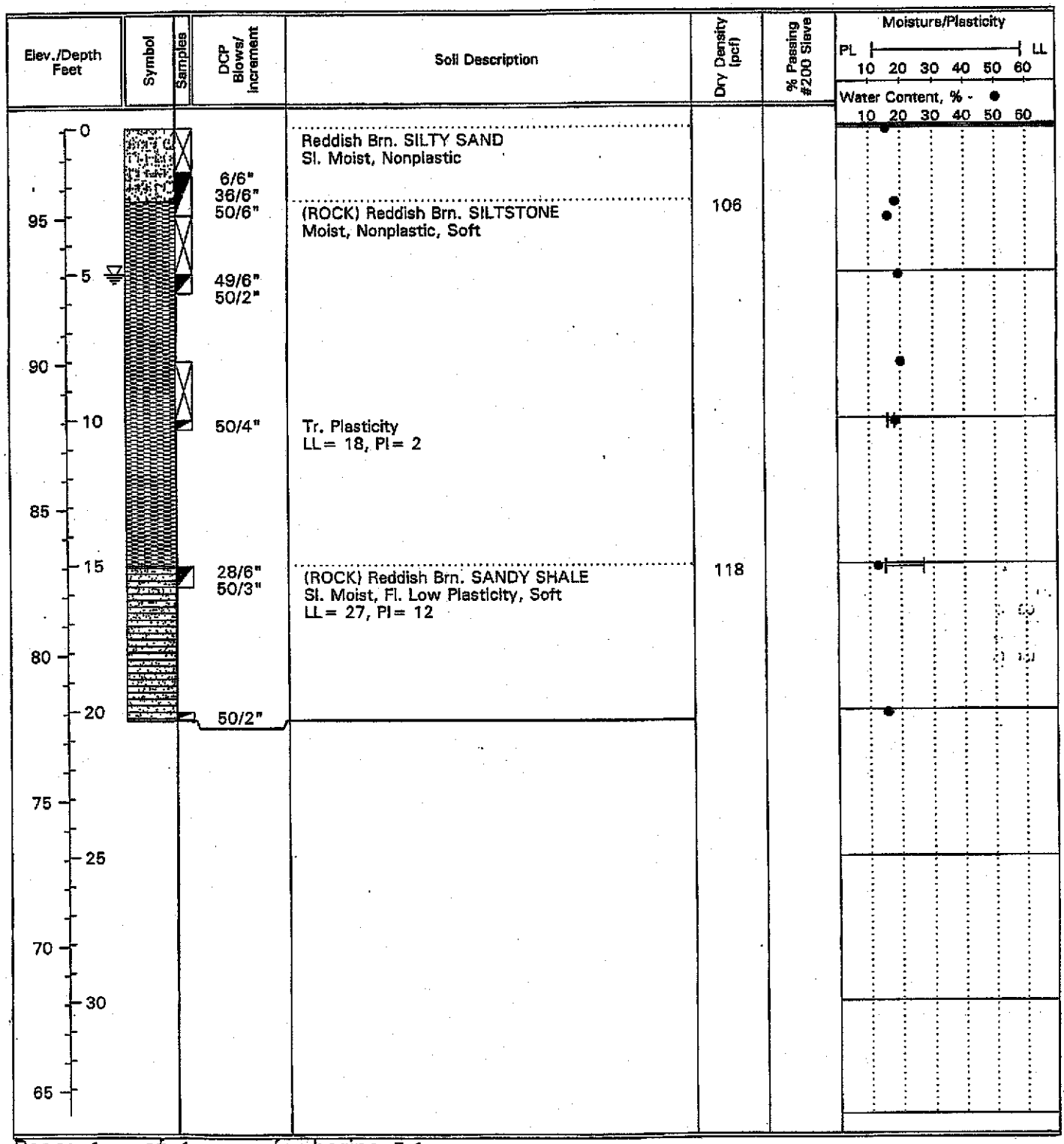
SOIL BORING LOG

Boring No. B-1

Project: Thelma Parks Elementary School Building Addition
Project Location: Oklahoma City, OK
Boring Location: S. end of the Bldg. addition footprint
Drill Method: CME- 55 w / 3.25"I.D. - 7.25" O.D. HSA
Surface Elevation: 98.1 ft.
Remarks: BM: F.F. of exisiting school bldg.

Project No.: 0309-3097
Date Drilled.: 6/3/09
Project Engineer: Vajra Rai
Field Logger: Chris Mcmullen
Water Depth: 5 ft. @ Completion



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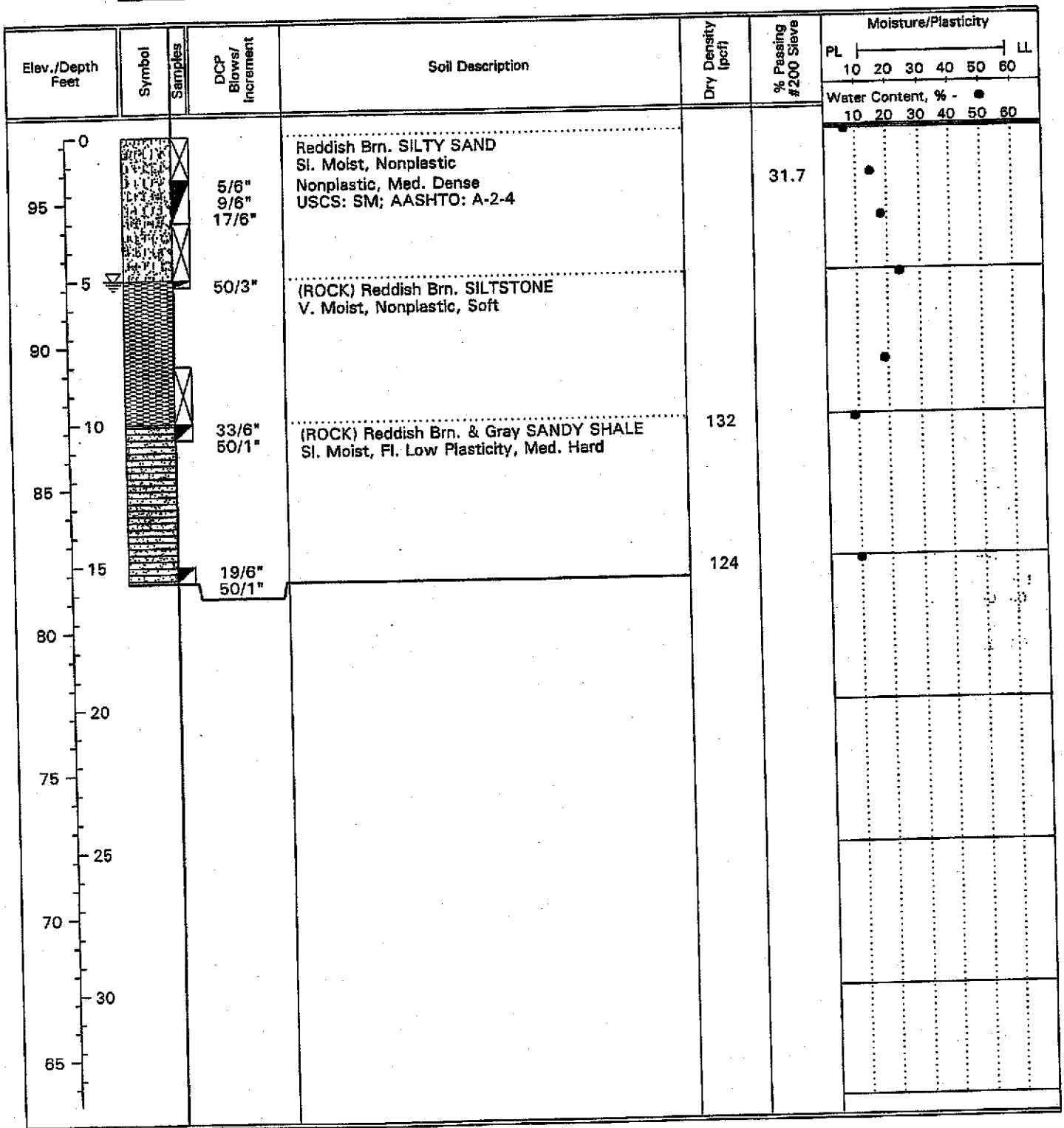
This document is preliminary in nature and is not a final, signed and sealed document.

SOIL BORING LOG

Boring No. B-2

Project: Thelma Parks Elementary School Building Addition
Project Location: Oklahoma City, OK
Boring Location: S.W corner of the Bldg. addition footprint
Drill Method: CME- 55 w / 3.25"I.D. - 7.25" O.D. HSA
Surface Elevation: 97.3 ft.
Remarks: BM: F.F. of exisiting school bldg.

Project No.: 0309-3097
Date Drilled.: 6/8/09
Project Engineer: Vajra Rai
Field Logger: Chris Mcmullen
Water Depth: 5 ft. @ Completion



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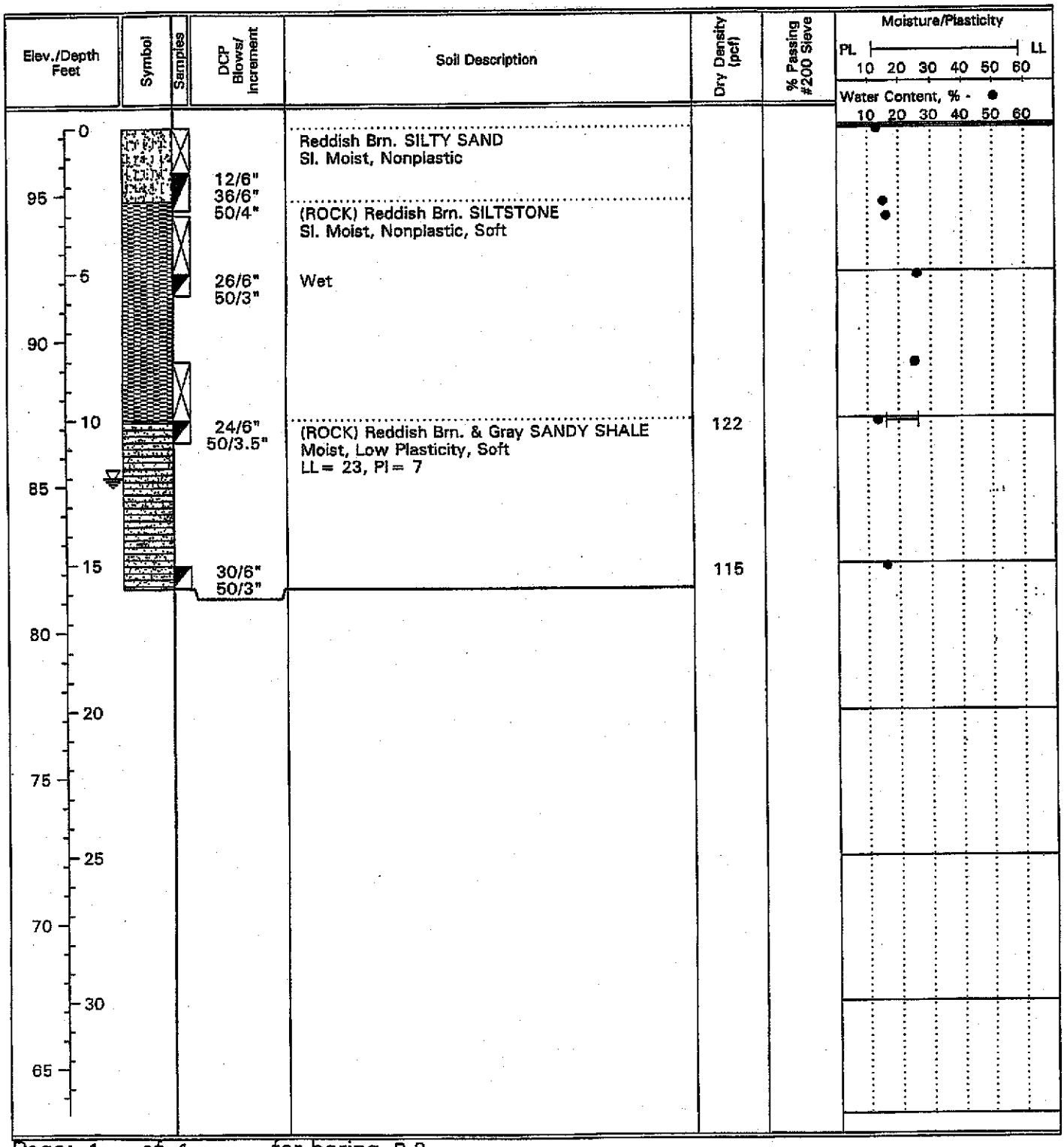
SOIL BORING LOG

Boring No. B-3

Project: Thelma Parks Elementary School Building Addition
Project Location: Oklahoma City, OK
Boring Location: Center of the Bldg. addition footprint
Drill Method: CME- 55 w / 3.25"I.D. - 7.25" O.D. HSA
Surface Elevation: 97.3 ft.
Remarks: BM: F.F. of exisiting school bldg.

Project No.: 0309-3097
Date Drilled.: 6/3/09
Project Engineer: Vajra Rai
Field Logger: Chris Mcmullen
Water Depth: 12 ft. @ Completion



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SOIL BORING LOG

Boring No. B-4

Project: Thelma Parks Elementary School Building Addition
Project Location: Oklahoma City, OK
Boring Location: N.W corner of the Bldg. addition footprint
Drill Method: CME- 55 w / 3.25"I.D. - 7.25" O.D. HSA
Surface Elevation: 95.2 ft.
Remarks: BM: F.F. of exisiting school bldg.

Project No.: 0309-3097
Date Drilled.: 6/8/09
Project Engineer: Vajra Rai
Field Logger: Chris Mcmullen
Water Depth: 12 ft. @ Completion

Elev./Depth Feet	Symbol	Samples	DCP Blows/ Increment	Soil Description	Dry Density (pcf)	% Passing #200 Sieve	Moisture/Plasticity
95 – 0			5/6" 6/6" 19/6"	Reddish Brn. SILTY SAND Sl. Moist, Nonplastic Moist, Med. Dense	111		PL – LL 10 20 30 40 50 60 Water Content, % - ● 10 20 30 40 50 60
				Reddish Brn. SANDY SHALE Sl. Moist, Fl. Low Plasticity LL= 26, PI= 13			
90 – 5			3/6" 5/6" 10/6"	Reddish Brn. SANDY CLAY Sl. Moist, Fl. Low Plasticity, Stiff	113		
				Reddish Brn. SANDY SHALE Sl. Moist, Fl. Low Plasticity			
85 – 10			30/6" 50/2"	(ROCK) Reddish Brn. SANDY SHALE Sl. Moist, Low Plasticity, Med. Hard LL= 27, PI= 7	123		
80 – 15			50/2"	SPT Refusal @ 15.5 feet			
75 – 20							
70 – 25							
65 – 30							

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GEOTECHNICAL SERVICES

This document is preliminary in nature and is not a final, signed and sealed document.

SOIL BORING LOG

Boring No. B-5

Project: Thelma Parks Elementary School Building Addition
Project Location: Oklahoma City, OK
Boring Location: N.E. corner of the Bldg. addition footprint
Drill Method: CME- 55 w / 3.25"I.D. - 7.25" O.D. HSA
Surface Elevation: 99.6 ft.
Remarks: BM: F.F. of exisiting school bldg.

Project No.: 0309-3097
Date Drilled.: 6/8/09
Project Engineer: Vajra Rai
Field Logger: Chris Mcmullen
Water Depth: 15 ft. @ Completion

Elev./Depth Feet	Symbol	Samples	DCP Blows/ Increment	Soil Description	Dry Density (pcf)	% Passing #200 Sieve	Moisture/Plasticity
0			1/6" 1/6" 1/6"	Reddish Brn. SILTY SAND Sl. Moist, Nonplastic Moist, Nonplastic, V. Loose USCS: SM; AASHTO: A-4(0)		36.4	PL — LL 10 20 30 40 50 60 Water Content, % - ● 10 20 30 40 50 60
95 5			3/6" 8/6" 45/6"	Reddish Brn. SILTSTONE Moist, Nonplastic, V. Stiff			
90 10			33/6" 18/6" 22/6"	Reddish Brn. & Gray SANDY SHALE Moist, Low Plasticity, V. Stiff			
85 15			34/6" 50/4"	(ROCK) Reddish Brn. & Gray SANDY SHALE Moist, Low Plasticity, Soft LL= 26, PI= 11			
80 20				SPT Refusal @ 20 feet			
75 25							
70 30							

KEY TO SYMBOLS

Symbol Description

STRATA SYMBOLS

 Silty Sand

 Siltstone

 Sandy Shale

 Sandy Clay

Misc. Symbols

 Water level at completion of drilling operations

Soil Samplers

 Bulk sample taken from auger flights, ASTM D1452

 Standard Penetration Test, ASTM D1586

DEFINITION OF DESCRIPTIVE TERMS

Consistency of Cohesive Soils (at moisture content near plastic limit):

- Very Soft - Easily penetrated 4" to 6" by fist; tall core will sag under its own weight.
- Soft - Easily molded by fingers.
- Firm - Can be penetrated 2" to 3" by thumb with moderate effort, imprinted with fingers.
- Stiff - Readily indented by thumb but penetrated only with great effort.
- Very Stiff - Readily indented by thumbnail, imprinted very slightly with pressure from fingers.
- Hard - Indented with difficulty by thumbnail, cannot be imprinted with fingers.

Density of Cohesionless Soils:

- Very Loose - less than 4 SPT "N" value corrected for overburden.
- Loose - 5 to 10 SPT "N" value corrected for overburden.
- Medium Dense - 11 to 30 SPT "N" value corrected for overburden.
- Dense - 31 to 50 SPT "N" value corrected for overburden.
- Very Dense - 51 to 50/6" SPT "N" value corrected for overburden.
- Hard - less than 6" penetration in 50 SPT "N" blows corrected for overburden (cemented).

Hardness of Rock:

- Very Soft - can be scratched readily by fingernail
- Soft - can be grooved readily by knife or pick
- Medium - can be grooved 0.05" deep by firm pressure of knife
- Moderately Hard - can be scratched by knife
- Hard - can be scratched by knife or pick only with difficulty
- Very Hard - cannot be scratched by knife or sharp pick

Other Terms Descriptive of Consistency:

- Brittle - Ruptures with little deformation
- Friable - Crumbles or pulverizes easily.
- Elastic - Returns to original length after small deformation.
- Spongy - Is very porous, loose and elastic.
- Sticky - Adheres or sticks to tools or hands.

In Situ Moisture Descriptions:

- Dry - powdery
- Slightly Moist - water not readily absorbed by paper
- Moist - water readily absorbed by paper
- Very Moist - water condenses on sample tray
- Wet - water drips from sample

Degree of Plasticity When Moist to Very Moist:

- Nonplastic - cannot be rolled into a ball
- Trace of Plasticity - can be rolled into a ball but not into a 1/8" thread
- Low Plasticity - barely holds its shape when rolled into a 1/8" thread
- Fairly Low Plasticity - 1/8" thread quickly ruptures when bent
- Medium Plasticity - 1/8" thread withstands considerable deformation without rupture.
- Fairly High Plasticity - difficult to rupture a 1/8" thread by bending.
- High Plasticity - can be kneaded without rupture; greasy texture.

Abbreviations:

V. - Very	Drk. - Dark	Blk. - Black
Tr. - Trace	Lt. - Light	Brn. - Brown
Fl. - Fairly	Med. - Medium	
Sl. - Slightly		

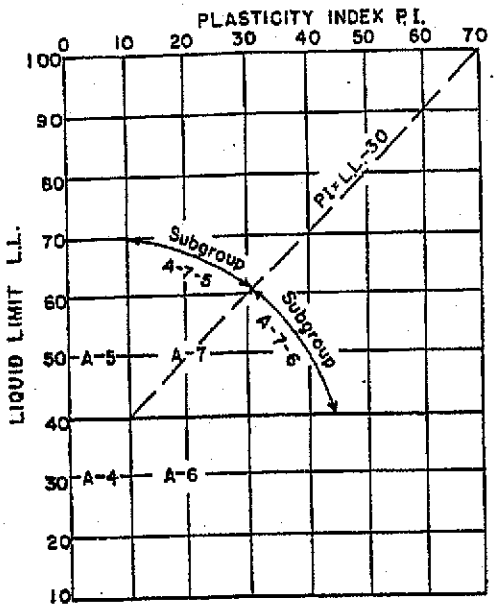
APPENDIX C

AASHTO Soil Classification System

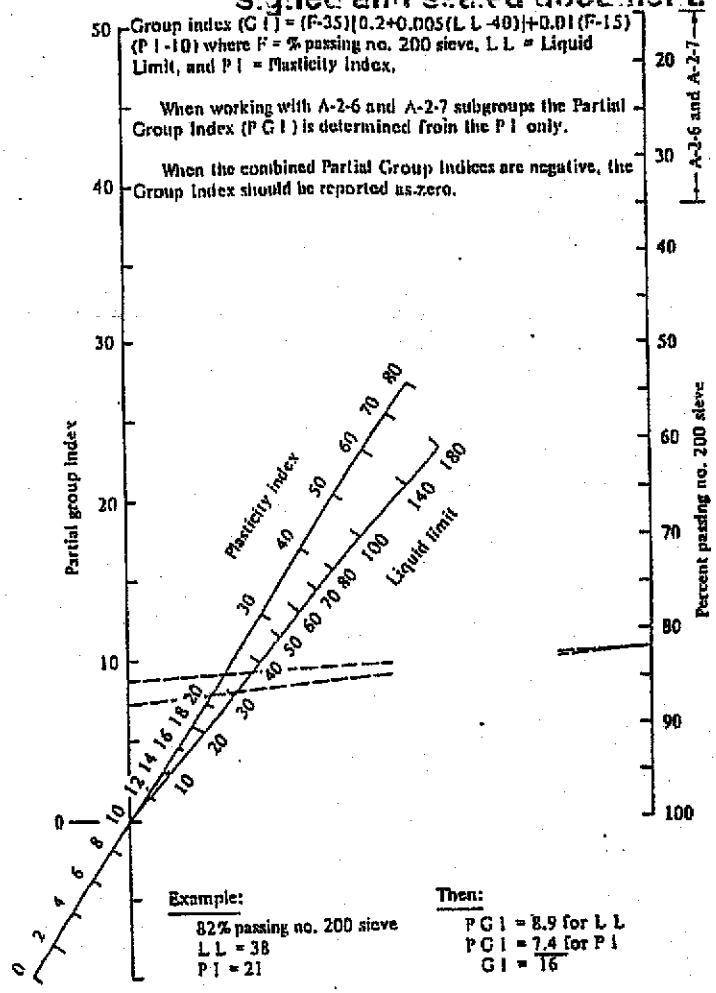
Unified Soil Classification System

Soil Classification System — American Association of State Highway and Transportation Officials

The tables and charts given below are from AASHTO Designation: M 145-83, The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. More detailed information as to the background and application of the system may be obtained from the report.



Liquid-limit and plasticity-index ranges for the A-4, A-5, A-6 and A-7 subgrade groups.



Group index chart

Classification of Soils and Soil-Aggregate Mixtures (with Suggested Subgroups)

General classification	Granular materials (35 per cent or less passing No. 200)							Silt-clay materials (More than 35 per cent passing No. 200)			
Group classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5; A-7-6
Sieve analysis; Per cent passing:											
No. 10	50 max.	—	—	—	—	—	—	—	—	—	—
No. 40	30 max.	50 max.	51 min.	—	—	—	—	—	—	—	—
No. 200	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of fraction passing No. 40:											
Liquid limit	—		—	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.		NP	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.*
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General rating as subgrade	Excellent to good							Fair to poor			

*P.I. of A-7-5 subgroup is equal to or less than L.L. minus 30. P.I. of A-7-6 subgroup is greater than L.L. minus 30

UNIFIED SOIL CLASSIFICATION
(Including Identification and Description)

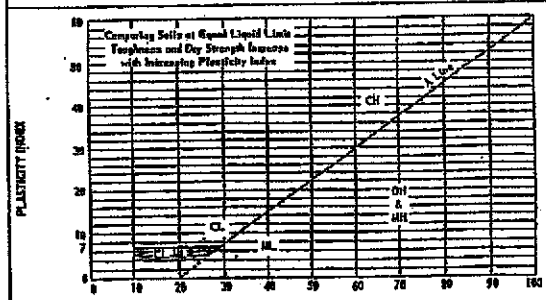
Major Divisions			Group Symbols	Typical Names	Field Identification Procedures (Excluding particles larger than 3 inches and basing fractions on estimated weights)	Information Required for Describing Soils	Laboratory Classification Criteria
1	2		3	4	5	6	7
Coarse-grained Soils: More than half of material is larger than No. 200 sieve size.	Gravels: More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size.)	Gravels with Few or No Fines (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		Not meeting all gradation requirements for GW
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel-sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).	Give typical names; indicate approximate percentages of sand and gravel, maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.	Atterberg limits below "A" line or PI less than 4 — Atterberg limits above "A" line with PI greater than 7 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel-sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size. (For visual classification, the 1/4-in. size may be used as equivalent to the No. 4 sieve size.)	Clean Sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.	Example: Silty sand, gravelly; about 20% hard, angular gravel particles 1/2-in. maximum size; rounded and subangular sand grains coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			SP	Poorly-graded sands, gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.		Not meeting all gradation requirements for SW
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).		Atterberg limits below "A" line or PI less than 4 — Atterberg limits above "A" line with PI greater than 7 — Limits plotting in hatched zone with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).		
Fine-grained Soils: More than half of material is smaller than No. 200 sieve size. The No. 200 sieve size is about the smallest particle visible to the naked eye.	Silts and Clays: Liquid limit less than 50				Identification Procedures on Fraction Smaller than No. 40 Sieve Size		
					Dry Strength (Crushing characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)
			ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium
			OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight
	Silts and Clays: Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture.		

Use graduation curve in identifying the fractions as given under field identification.

Determine percentages of gravel and sand from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows:

Less than 5%
More than 12%
5% to 12%

GW, GP, SW, SP, GM, GC, SM, SC
Borderline cases requiring use of dual symbols.



PLASTICITY CHART

For laboratory classification of fine-grained soils

(1) Boundary classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well-graded gravel-sand mixture with clay binder. (2) All sieve sizes on this chart are U. S. standard.

FIELD IDENTIFICATION PROCEDURES FOR FINE-GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve-size particles, approximately 1/64 in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky. Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics)

After removing particles larger than No. 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit)

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally losing its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Adopted by Corps of Engineers and Bureau of Reclamation, January 1952

APPENDIX D

Summary of Laboratory Test Results

SUMMARY OF LABORATORY TEST RESULTS

Client: Oklahoma City Metropolitan Area Public Schools Trust

Project: Thelma R. Parks Elementary School

Date: June 11, 2009

Project No.: 0309-3097

0. Boring No.	Sample I.D.	Depth (ft.)	Moisture Content (%)	Dry Density (pcf)	Atterberg Limits (% Moisture)			Sieve Analysis (% Passing)					Soil Classification	
					LL	PL	PI	#4	#10	#40	#100	#200	USCS	AASHTO
B-1	A	0-1.5	15.5											
	B	1.5-3	18.4	106										
	C	3-5	16.1											
	D	5-6.5	19.3											
	E	8-10	20.1											
	F	10-11.5	18.4		18	16	2							
	G	15-16.5	12.7	118	27	15	12							
	H	20-21.5	15.6											
B-2	A	0-1.5	6.5											
	B	1.5-3	14.7		-	-	Np	100	100	100	81	31.7	SM	A-2-4
	C	3-5	18.1											
	D	5-6.5	23.7		-	-	Np							
	E	8-10	18.8											
	F	10-11.5	8.7	132										
	G	15-16.5	9.8	124										
B-3	A	0-1.5	12.9											
	B	1.5-3	15.0											
	C	3-5	16.0											

STANDARD TESTING AND ENGINEERING COMPANY

GEOTECHNICAL SERVICES

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SUMMARY OF LABORATORY TEST RESULTS

Client: Oklahoma City Metropolitan Area Public Schools Trust

Date: June 11, 2009

Project: Thelma R. Parks Elementary School

Project No.: 0309-3097

0. Boring No.	Sample I.D.	Depth (ft.)	Moisture Content (%)	Dry Density (pcf)	Atterberg Limits (% Moisture)			Sieve Analysis (% Passing)					Soil Classification	
					LL	PL	PI	#4	#10	#40	#100	#200	USCS	AASHTO
B-3 (Cont.)	D	5-6.5	25.7											
	E	8-10	25.0											
	F	10-11.5	13.4	122	23	16	7							
	G	15-16.5	16.0	115										
B-4	A	0-1.5	14.1											
	B	1.5-3	18.5	111										
	C	3-5	18.1		26	13	13							
	D	5-6.5	18.8	113										
	E	8-10	11.6											
	F	10-11.5	9.2	123	27	17	7							
B-5	A	0-1.5	7.0											
	B	1.5-3	11.8		-	-	Np	100	100	100	87	36.4	SM	A-4(0)
	C	3-5	15.1											
	D	5-6.5	20.0											
	E	8-10	18.3											
	F	10-11.5	12.4											
	G	15-16.5	17.0	118	26	15	11							

STANDARD TESTING AND ENGINEERING COMPANY

GEOTECHNICAL SERVICES

This document is preliminary in nature and is not a final signed and sealed document.

SIDEWALK RECOMMENDATIONS
THELMA R. PARKS ELEMENTARY SCHOOL IN OKLAHOMA CITY, OKLAHOMA
BOYNTON WILLIAMS AND ASSOCIATES
MR. STEVE CHESSER
AUGUST 7, 2009

Sidewalk recommendations presented below are based on the report of geotechnical investigation of the Thelma R. Parks Elementary School Building Addition in Oklahoma City, Oklahoma prepared for OCMAPS; Project No. 0309-3097 dated June 30, 2009.

Concrete Paving Recommendations for Sidewalk:

1.) Subgrade Preparation:

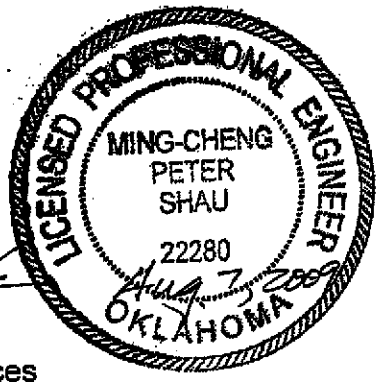
Subgrade should be stripped of the all vegetation, and any other deleterious materials, and packed down tightly using jumbo jack or equivalent equipment.

2.) minimum thickness of sand: 2 inches

3.) minimum thickness of concrete: 4 inches

Prepared by:

Vajra Rai
Staff Geotechnical Engineer



Ming-Cheng Peter Shau, P.E.
Manager, Geotechnical Services

Certificate of Authorization No. 77, Expiration 6/30/2011